PLANO 5487-004/C

MANUAL DE OPERACIÓN

MÓDULOS DAF PLANTA LA TEJA

INTRODUCCIÓN

El presente manual describe funcionamiento y operación de los módulos DAF de tratamiento de efluentes de piletas API de la refinería ANCAP-La Teja, Montevideo, Uruguay.

Este documento se complementa con
1) Diagrama P&I, plano 5487-001/D
2) Descripción de automatismo, plano 5487-900/A
3) Esquema de funcionamiento de módulos de presurización, plano 5487-901/B

RESUMEN DEL PROCESO

El proceso de depuración es conocido como flotación DAF (Dissolved Air Flotation, Flotación por Aire Disuelto). La esencia del proceso es separar los restos de aceites y petróleos del efluente mediante micro burbujas de aire, que se adhieren a los aceites y los elevan a la superficie, de donde son removidos mediante rascadores de superficie.

Antes de ingresar a los flotadores, el efluente es acondicionado mediante agregado de productos químicos ("coagulante" y "floculante"), en las cubas de coagulación (agitación rápida) y floculación (agitación lenta).

Para todo ello, la planta cuenta con:

1) Bombas de elevación (2 en operación, 1 en stand-by) que llevan el efluente desde el canal de salida de las piletas API hasta equipos las cubas de coagulación y floculación.
   Estas bombas son los equipos **8121-J/8122-J/8123-J.**
2) Un pretratamiento de coagulación y floculación, compuesto por
   a) Flash mixer (cámara de agitación rápida), donde se produce la coagulación. Es el equipo **8124-L.**
   b) Floculador, equipo **8125-L.**
   c) Equipos de dosificación de coagulante y floculante, bombas **8128-J/8128-JA/8129-J/8129-JA.**
3) Dos sistemas de flotadores, cada uno compuesto por
   a) El flotador propiamente dicho, es decir el recipiente metálico donde se produce la flotación, equipos **8130-L y 8135-L.**
   b) Unidad de presurización asociada (bombas de presurización **8131-J/8131-JA/8136-J/8136-JA**, balón de presurización **8134-F/8139-F**, compresores **8133-J/8138-J,** y válvulas asociadas)
   c) Bombas de extracción de flotantes **8132-J/8137-J**.

El sistema está diseñado para tratar:
Caudal: 250 m3/h en cada flotador, 500 m3/h caudal total de planta.
Entrada: efluente de pileta API, contenido de hidrocarburos 150-300 ppm.
Salida: máximo 20 ppm de hidrocarburos, 30 ppm sólidos en suspensión.

Como todo equipo de separación, esta planta tiene una entrada y varias salidas, a saber:

1) Entrada: efluente de piletas API
2) Salidas:
   a) Agua tratada: por canaleta colectora y vertedero se envía directamente a la bahía.
   b) Espumas (flotantes), colectadas en la superficie del flotador por los rascadores, y luego bombeadas a la fosa recolectora de aceites.
   c) Purga de lodos.

DESCRIPCIÓN BREVE DE CADA EQUIPO

Bombas de elevación 8121-J/8122-J/8123-J

Las bombas de elevación son bombas sumergibles, instaladas en el canal de salida de piletas API y se encargan de llevar el efluente de las piletas API hasta la cámara de agitación rápida. Cada bomba tiene un caudal de 250m3/h, previéndose utilizar dos bombas (500 m3 en total) y la tercera en stand-by.

Las bombas pueden operar en manual mediante botonera, o en automático según el nivel de agua en el canal (ver descripción de automatismo, plano 5487-900/A). En caso de ser colocadas en automático, dependiendo el nivel de agua en el canal funcionarán:

1) Ninguna bomba, si no hay nivel suficiente
2) 1 bomba, si el nivel es bajo (250 m3/h)
3) 2 bombas, si el nivel es normal (500 m3/h)

En caso de que las piletas API descarguen un caudal mayor a 500m3/h, se podrá optar por:

1) Dejar parcialmente abierta la compuerta de salida del canal y que el exceso se vierta directamente a la bahía.
2) Encender la tercera bomba: en este caso la planta operará con 750 m3/h, lo que es más que su caudal de diseño por lo que la calidad de agua a la salida y espumas recolectadas empeorará.

Agitador rápido y floculador 8124-L y 8125-L

Luego de pasar por las piletas API y las bombas elevadoras, el efluente llega a las cubas de coagulación y floculación. Al llegar aquí, las partículas de aceite y petróleo remanentes se encontrarán dispersas en forma de partículas muy pequeñas (emulsión), con tendencia a rechazarse entre si. Es conveniente, previo al ingreso a los flotadores, "juntar" estas partículas unas con otras, lo que permitirá que floten mejor.

Para lograrlo, primero hay que "coagular" el efluente, lo que significa anular la tendencia de las partículas a rechazarse mutuamente. Se consigue mediante el agregado de un producto químico especial ("coagulante") y agitando a altas velocidades, lo que permite al coagulante mezclarse con todo el efluente.

Seguidamente, hay que "flocular" el efluente, es decir permitir que las partículas de petróleo y aceites se junten entre sí formando partículas de mayor tamaño ("flocs"). Esto se hace agregando otro producto químico ("floculante") y agitando. Al contrario que en la coagulación, hay que agitar en forma lenta, para permitir que se formen los flocs: una agitación demasiado rápida los destruiría.

Para llevar a cabo estos procesos:

1) En la cámara de coagulación, se dosifica coagulante mediante las bombas **8128-J/8128-JA**, mientras que el agitador rápido **8124-L** produce la suficiente turbulencia

para llevar a cabo el proceso. La velocidad del agitador rápido se puede regular mediante variador de frecuencia instalado en el tablero.

2) En el floculador, se dosifica un floculante mediante las bombas **8129-J/8129-JA** y mediante agitación lenta con el floculador **8125-L** se permite a las partículas de aceite entrar en contacto unas con otras y formar partículas más grandes. La velocidad del floculador se regula desde el reductor del equipo.

La dosificación se realiza mediante los equipos de dosificación instalados al pie del floculador. Las bombas de dosificación pueden operar en manual por botonera o en automático según el programa de la planta (ver descripción de automatismo).

La preparación y dosificación de productos químicos se tratan en el apartado "Coagulación y floculación - detalle".

Flotadores

Los flotadores son cubas metálicas cuya principal función es crear las condiciones hidráulicas para permitir:

1) La generación de micro burbujas en la zona inferior
2) La separación efluente-espumas en la superficie.

La esencia de la generación de micro burbujas es la siguiente: el aire se disuelve en el agua, y a mayor presión se puede disolver más aire. A la inversa, si se ***disminuye*** la presión el agua "libera" el aire disuelto en forma de micro burbujas[1].

Las micro burbujas se generan según en el siguiente proceso:

1) Una parte del agua tratada a la **salida** de los flotadores se recicla a la unidad de presurización.
2) En la unidad de presurización, el agua se bombea y se mezcla con aire en el balón de presurización.
3) El agua, ahora saturada en aire, se despresuriza en dos pasos mediante las válvulas entre el balón de presurización y el flotador.
4) Al entrar al flotador, la corriente despresurizada desprende el aire en forma de micro burbujas.
5) La corriente despresurizada se mezcla, dentro del flotador, con el efluente proveniente del floculador.
6) Las micro burbujas se adhieren a las impurezas del agua cruda (aceites, petróleo) y las hace flotar.

En la superficie del flotador, los barredores de superficie **8130-L/8135-L** colectan las espumas, que son enviadas a las cámaras de bombeo **8132-J/8137-J** para ser luego enviadas a las fosas recolectoras de aceites. Estas fosas cuentan con una línea de agua: dependiendo la densidad y viscosidad de las espumas será necesario agregar agua para que puedan ser correctamente bombeadas. Las bombas funcionan en manual o en automático mediante el sensor de nivel por ultrasonido.

[1] En forma similar a cuando se destapa una bebida gaseosa: al sacar la tapa, la presión interna disminuye y la bebida desprende burbujas.

El efluente tratado es enviado por gravedad a la canaleta de salida a la bahía. Esta canaleta cuenta con un vertedero en "V" y una regla graduada para estimar, en forma visual, el caudal tratado.

El flotador cuenta también con un barredor de fondos y purga de barros. Esta purga es una medida de seguridad: en principio, de funcionar correctamente las piletas API el efluente no debiera tener ningún tipo de sedimentos y esta purga debiera ser solamente agua. En caso de detectarse sedimentos indica un mal funcionamiento de las piletas API.

Sistema de presurización

El sistema de presurización es el "corazón" del proceso, y se lo describe con detenimiento en el capítulo "Sistema de presurización - Detalle".

El sistema de presurización cuenta con:
Bombas de presurización: en cada sistema hay dos bombas, una de ellas en stand-by. Estas bombas reciclan parte del líquido tratado, lo presurizan hasta la presión de trabajo y lo inyectan en el balón de presurización.
En el balón de presurización, se mezcla el agua presurizada con aire proveniente del compresor 8133-J/8138-J. El balón trabaja con nivel variable: mediante un sensor de nivel se inyecta aire (cuando el nivel de agua es elevado) o se detiene la inyección (cuando el nivel es bajo).
A la salida del balón, un caudalímetro permite leer el caudal circulado. Por diseño, el caudal debe ser alrededor de 75 m3/h
Luego del caudalímetro, la corriente se bifurca. En cada bifurcación hay tres válvulas en línea, que permiten una despresurización gradual de la corriente antes del ingreso al flotador.

El sistema está completamente automatizado. Si bien las bombas y compresores pueden operarse en forma manual para casos de mantenimiento, el sistema como conjunto no puede operarse manualmente: todas las operaciones a realizar se llevan a cabo desde la consola. Por otra parte, excepto por desperfecto o mantenimiento, el sistema no requiere operación de ningún tipo.

Operación por consola en tablero

La consola alfanumérica tipo "Magelis" es la interfase con el operador, y permite:
1. Visualizar e identificar las alarmas activas, y reconocerlas: en todo momento que exista una alarma, aparecerá descripta en la pantalla.
2. Modificación de los tiempos de operación (tiempos de purgas, tiempos del sistema de presurización).
3. Dar orden de marcha al sistema de presurización del flotador I: mediante esta orden, el sistema completo comenzará a funcionar.
4. Dar orden de marcha al sistema de presurización del flotador II (ambos sistemas funcionan en forma independiente).
5. Forzar apertura de todas las electroválvulas y solenoides.

OPERACIÓN

La planta es automática, por lo que las operaciones que necesita son:

1) En planta
   a) Reposición y preparación de productos químicos: el coagulante y el floculante deben ser repuestos periódicamente. Ver detalle de preparación en "Coagulación y floculación - detalle"
   b) Inspección de rutina:
      i) Control visual de:
         (1) Cámaras de coagulación y floculación
         (2) Flotadores
         (3) Cámara de espumas de cada flotador
         (4) Módulo de presurización de cada flotador
      ii) Control de caudal a la salida de planta
      iii) Purga de agua acumulada en la línea de aire comprimido
      iv) Control de sala de tablero:
         (1) Marcha de motores
         (2) Alarmas en consola
   c) Limpieza general y mantenimiento, lubricación, etc.
2) Análisis de laboratorio:
   a) Análisis de calidad de agua entrada-salida
   b) Ensayos de floculación ("jar-test") para optimización de
      i) Dosis coagulante/floculante
      ii) Velocidad de agitación

En todo lo que hace a la operación y mantenimiento específico de cada equipo (bombas elevadoras, bombas de dosificación, caudalímetros) se deberá consultar los manuales de los respectivos fabricantes. Respetar en todo momento las indicaciones de inspecciones, recambios de piezas y lubricantes, etc.

COAGULACIÓN Y FLOCULACIÓN – DETALLE.

El proceso de coagulación y floculación del efluente resulta esencial para un buen rendimiento de la planta, ya que:
1) Es indispensable para un correcto funcionamiento de los flotadores y lograr una separación eficaz,
2) Impacta en el costo de operación a través del consumo de reactivos,
3) Optimizar el proceso puede permitir tratar caudales superiores a los de diseño,
4) La preparación de productos es la principal tarea a realizar por los operadores.

Los parámetros a optimizar son cuatro:
1) Dosis de coagulante
2) Agitación en la cámara de coagulación
3) Dosis de floculante
4) Agitación en la cámara de floculación

El "óptimo" buscado es la mínima cantidad de coagulante y floculante (costo operativo) compatible con una correcta depuración del efluente (es decir, niveles de impurezas en el efluente volcado a la bahía por debajo de lo exigido).

El proceso de optimización se realiza mediante los siguientes pasos:
1) Determinación de parámetros óptimos en laboratorio (ensayo de jar-test)
2) Realizar ensayos entrada-salida de planta, para determinar petróleo en agua antes y después del tratamiento.
3) Llevar parámetros óptimos determinados en punto 1) a la planta.
4) Realizar ensayos entrada-salida ídem punto 2)
5) Comparar 2 y 4, reajustar si es necesario

Ensayos de Jar-Test

El ensayo de jar test (test de jarras) permite:
1) determinar la dosis óptima de reactivos para una flotación (también puede utilizarse en una decantación).
2) Comparar distintos productos entre sí
3) Como ensayo de rutina de operación, para corroborar si la dosis utilizada es la correcta.

El proceso consiste en dosificar diferentes dosis de coagulante y floculante en jarros agitados, que luego se dejan reposar para determinar la mejor dosis. En general, lo que se busca es optimizar uno de los siguientes factores:
1) O bien la dosis que consigue el mejor resultado (optimización de la depuración)
2) O bien la mínima dosis que consigue un resultado "suficiente" (optimización del consumo de reactivos)

El proceso es el siguiente:
1) Dosis óptima de coagulante:
   a) Tomar una muestra de varios litros de efluente de las piletas API

b) Homogeneizar la muestra mediante agitación con una cuchara, distribuir cantidades iguales en los distintos frascos del jar-test (en general, 4 o 6 vasos de 1 o 2 litros, dependiendo del modelo de equipo utilizado).
c) Agitar a unas 150-200 r.p.m.
d) Agregar cantidades crecientes de coagulante en los distintos vasos: 0.5ppm, 1ppm, 1.5ppm…
e) Mantener la agitación rápida 3 minutos.
f) Pasar a agitación suave (40-50 r.p.m.) durante 15 minutos, observar la formación de flóculos,
g) Luego de los 15 minutos, detener la agitación y dejar reposar. Comparar la formación de flóculos y su capacidad de flotación. En caso de requerir mayor precisión además de la comparación visual puede medirse petróleo en agua y turbiedad.
h) En caso que las dosis óptima sea alguna de las concentraciones "extremas" (la menor o la mayor), repetir la experiencia utilizando
   i) Dosis mayores si la dosis óptima fue la mayor
   ii) Dosis menores si la dosis óptima fue la menor
   Por ejemplo, si se realizó el ensayo con dosis de 0.5, 1, 2 y 3 ppm, y la mejor dosis resulta ser 3ppm, realizar otro ensayo con 2, 3, 4 y 5 ppm.

2) Dosis óptima de floculante
   a) Tomar una muestra de varios litros de efluente de las piletas API
   b) Homogeneizar la muestra mediante agitación con una cuchara, distribuir cantidades iguales en los distintos frascos del jar-test (en general, 4 o 6 vasos de 1 o 2 litros).
   c) Agitar a unas 150-200 r.p.m.
   d) Agregar en todos los jarros la dosis óptima de coagulante (determinado en el paso 1)
   e) Mantener la agitación rápida 3 minutos.
   f) Pasar a agitación suave (40-50 r.p.m.)
   g) Agregar cantidades crecientes de floculante en los distintos vasos: 0.5ppm, 1ppm, 1.5ppm…
   h) Mantener la agitación suave durante 15 minutos, observar la formación de flóculos,
   i) Luego de los 15 minutos, detener la agitación y dejar reposar. Comparar la formación de flóculos y su capacidad de flotación. En caso de requerir mayor precisión además de la comparación visual puede medirse petróleo en agua y turbiedad.
   j) En caso que las dosis óptima sea alguna de las concentraciones "extremas" (la menor o la mayor), repetir la experiencia utilizando
      i) Dosis mayores si la dosis óptima fue la mayor
      ii) Dosis menores si la dosis óptima fue la menor

El ensayo de jar test no sólo sirve para determinar la dosis óptima de un producto, también permite comparar un producto con otro (tanto dos productos distintos de un mismo proveedor, como productos de proveedores distintos). Para ello, se determina primero la dosis óptima de cada producto y luego se compara dosis óptima de un producto versus dosis óptima de otro.

Ensayos en planta

Determinadas las dosis óptimas (coagulante + floculante), se dosificará en planta según esa dosis. En caso de probar una dosis distinta, se deberán realizar los suficientes ensayos de entrada y salida como para asegurarse que la planta trabaja estable ***antes*** de modificar la dosis, para compararlos con los ensayos ***después*** de la dosis. Si bien es posible determinar visualmente la formación de flóculos en el floculador, el único ensayo válido es la comparación de la calidad del efluente de salida antes y después del cambio de dosis.

Recordar que los cambios *no son instantáneos*: un cambio en la dosis requerirá entre dos y tres horas en ser perceptible a la salida (el tiempo de retención hidráulico del sistema).

La optimización de la agitación se realiza directamente en planta, ya que la simulación en laboratorio es muy inexacta. Para ello, se procede en forma similar a la modificación de la dosis: comparar ensayos antes y después de la modificación de velocidad.

La velocidad del agitador de la cámara de coagulación se regula mediante un variador de frecuencia instalado dentro del tablero (consultar manual del equipo). La velocidad del floculador se modifica desde el reductor del agitador: posee 5 velocidades.

IMPORTANTE: ¡Testear de un parámetro a la vez, si se intenta modificar dos o más parámetros a la vez nunca se estará seguro de qué es lo que está ocurriendo! Por ejemplo, no intentar a la vez optimizar la dosis de floculante y la velocidad del floculador. Por el contrario, determinar una variable primero (por ejemplo, la dosis), y luego *manteniendo la dosis constante* optimizar la velocidad.

Preparación de reactivos

La dosificación de coagulante y floculante son similares, a continuación se ejemplifica con coagulante:

1) Se determina en laboratorio la dosis óptima (por ejemplo, 1 ppm). Dado que en planta lo más sencillo es preparar el reactivo midiendo volumen y no peso (es más fácil para los operarios agregar 5 litros que 5 kilos), se aconseja utilizar como unidad para las ppm el ml/m3 en vez del g/m3.
2) Se determina el caudal operativo "Q" de la planta (en general, 500 m3/h)
3) Se determina la dilución a la que se debe preparar el coagulante en el tanque de reactivos. Los polímeros orgánicos no se dosifican puros, sino que tiene que ser diluidos. La dosificación óptima debe ser consultada con el fabricante, y en general es entre el 0.5 y 5%. Para este ejemplo, supongamos preparación al 5%. Eso significa que en los tanques de reactivos se deberá mezclar 5 litros de producto por cada 100 lts de agua.
4) Se prepara los químicos según la disolución requerida. Para la preparación de reactivos, cada sistema de dosificación cuenta con dos tanques, de manera de poder preparar la dilución en uno de los tanques mientras se dosifica al proceso con el otro. Para ello:
   a) Cada tanque cuenta con una válvula de salida que los conecta a las bombas dosificadoras. Por supuesto, debe estar abierta la válvula del tanque del que se

está dosificando, y cerrada la válvula del tanque en la que se está preparando la dilución.

b) Cada tanque posee un sensor de nivel, para interrumpir la dosificación en caso de falta de producto. A pie de los equipos hay una llave selectora que permite elegir cual es el tanque activo, de manera de poder vaciar el otro tanque sin que la falta de nivel afecte al proceso. La llave selectora debe estar apuntando hacia la derecha en caso que el tanque de la derecha sea el que se está utilizando para dosificar, y para la izquierda cuando se dosifique con el tanque de la izquierda.

c) Para preparar el producto
   i) Se lleva el tanque hasta 1000 litros.
   ii) Se agrega la cantidad de producto de acuerdo a la dilución (notar que si el tanque tenía 300 litros, se deberá calcular la cantidad de producto a agregar solamente sobre los 700 litros de agua agregados).
   iii) Agitar para lograr una mezcla homogénea. La agitación depende de la naturaleza del producto: algunos son totalmente miscibles y sólo necesitan una agitación de algunos minutos, mientras que otros tienden a formar dos fases y por lo tanto requieren agitación continua.
   iv) Abrir la válvula de salida del tanque, cerrar la válvula de salida del otro tanque.
   v) Colocar la llave selectora en la posición del tanque correspondiente.

5) Se calcula el caudal "q" a dosificar según:

$$q = \frac{Q * dosis}{dilución} = \frac{500\, {}^{m^3}\!/_{h} * 1\, {}^{g}\!/_{m^3}}{50\, {}^{g}\!/_{l}} = 10\, {}^{l}\!/_{h}$$

6) Se setea la bomba al porcentaje adecuado: la perilla de regulación de caudal de las bombas dosificadoras viene reguladas en porcentaje de caudal máximo. El caudal máximo puede ser leído en la placa de la bomba. Siguiendo el ejemplo anterior, si la bomba es de 50 l/h de caudal máximo, para dosificar 10 l/h hay que setear la bomba al 20%. Con la probeta de calibración se corrobora que el caudal sea el correcto.

IMPORTANTE: Aún en caso que no se modifique la dosis, es importante controlar el caudal de dosificación, para comprobar que las bombas funcionan correctamente, que la cañería o el filtro de aspiración no se encuentra tapado, etc.

PARÁMETROS DE FUNCIONAMIENTO

Estos parámetros son los seteados durante la puesta en marcha de la planta, realizada en Noviembre del 2001. Referirse a estos parámetros en caso de desajuste accidental.

Parámetros de diseño

- Caudal de la planta: 500 m3/h
- Caudal por flotador: 250 m3/h
- Calidad agua de entrada:
  - Hidrocarburos: 150-300 ppm
- Calidad agua de salida:
  - Hidrocarburos: menor a 20 ppm.
  - Sólidos en suspensión: inferior a 30 ppm.

Parámetros de operación:

- Coagulación
  - Velocidad de agitación: 50 Hz
  - Coagulante: Nalco 4526
    - Dosis: 1ppm
    - Dilución: 1 litro producto/100 litros agua.
    - Caudal bomba dosificadora: 50 lts/minuto.
- Floculación
  - Velocidad de agitación: velocidad máxima
  - Floculante: Nalco 7128
    - Dosis: 1ppm
    - Dilución: 1 litro producto/100 litros agua.
    - Caudal bomba dosificadora: 50 lts/minuto.
- Purga de barros
  - Tiempo de válvula abierta: 30s
  - Tiempo de válvula cerrada: 900s.
- Presurización:
  - Presión en la bomba: 6,6-7 bar
  - Presión de operación del balón: 3 Kg./cm2
  - Caudal de presurización: 75 m3/h
  - Tiempos de operación del balón:
    - Llenado: 60s
    - Detención de aire: 10s
    - Entrada de aire: 60s
    - Despresurización: 10s
  - Presión de la regulación de aire: 4 bar.
  - Presión ante de válvulas PIC: 0.5 bar
- Nivel de agua en flotadores: para 250 m3/h en cada flotador, el nivel de agua está regulado a 1,5-2cm por debajo del borde superior de la tolva de recolección de espumas.

LISTADO DE EQUIPOS

TAG	EQUIPO
8121-J	BOMBA DE ELEVACIÓN
8122-J	BOMBA DE ELEVACIÓN
8123-J	BOMBA DE ELEVACIÓN
8124-L	AGITADOR RÁPIDO
8125-L	FLOCULADOR
8126-L	AGITADOR COAGULANTE
8126-LA	AGITADOR COAGULANTE
8127-L	AGITADOR FLOCULANTE
8127-LA	AGITADOR FLOCULANTE
8128-J	BOMBA DOSIFICADORA COAGULANTE
8128-J A	BOMBA DOSIFICADORA COAGULANTE
8129-J	BOMBA DOSIFICADORA FLOCULANTE
8129-J A	BOMBA DOSIFICADORA FLOCULANTE
8130-L	BARREDOR DE FONDO Y SUPERFICIE, FLOTADOR 1
8131-J	BOMBA DE PRESURIZACIÓN, FLOTADOR 1
8131-J A	BOMBA DE PRESURIZACIÓN, FLOTADOR 1
8132-J	BOMBA DE ESPUMAS, FLOTADOR 1
8133-J	COMPRESOR, FLOTADOR 1
8135-L	BARREDOR DE FONDO Y SUPERFICIE, FLOTADOR 2
8136-J	BOMBA DE PRESURIZACIÓN, FLOTADOR 2
8136-J A	BOMBA DE PRESURIZACIÓN, FLOTADOR 2
8137-J	BOMBA DE ESPUMAS, FLOTADOR 2
8138-J	COMPRESOR, FLOTADOR 2

LISTADO DE INSTRUMENTOS Y SOLENOIDES

TAG	EQUIPO
TSH 8121J	SENSOR ALTA TEMPERATURA, INTERNO BOMBA 8121-J
XSH 8121J	SENSOR HUMEDAD, INTERNO BOMBA 8121-J
TSH 8122J	SENSOR ALTA TEMPERATURA, INTERNO BOMBA 8122-J
XSH 8122J	SENSOR HUMEDAD, INTERNO BOMBA 8122-J
TSH 8123J	SENSOR ALTA TEMPERATURA, INTERNO BOMBA 8123-J
XSH 8123J	SENSOR HUMEDAD, INTERNO BOMBA 8123-J
LSHH 81201	INTERRUPTOR FLOTANTE DE NIVEL, PILETA API
LSH 81201	INTERRUPTOR FLOTANTE DE NIVEL, PILETA API
LS 81201	INTERRUPTOR FLOTANTE DE NIVEL, PILETA API
LSL 81201	INTERRUPTOR FLOTANTE DE NIVEL, PILETA API
LSLL 81201	INTERRUPTOR FLOTANTE DE NIVEL, PILETA API
LSL 81202	SENSOR DE NIVEL, CUBA “A” DE COAGULANTE
LSL 81203	SENSOR DE NIVEL, CUBA “B” DE COAGULANTE
LSL 81204	SENSOR DE NIVEL, CUBA “A” DE FLOCULANTE
LSL 81205	SENSOR DE NIVEL, CUBA “B” DE FLOCULANTE
HS 81202	SWITCH SELECTOR CUBA “A”-CUBA “B” DE COAGULANTE
HS 81204	SWITCH SELECTOR CUBA “A”-CUBA “B” DE FLOCULANTE
XSH 81206	SENSOR DE TORQUE, BARREDOR DE FLOTADOR 8130-L
XSH 81230	SENSOR DE TORQUE, BARREDOR DE FLOTADOR 8135-L
LSL 81207	INTERRUPTOR FLOTANTE DE NIVEL, FLOTADOR 8130-L
LSL 81231	INTERRUPTOR FLOTANTE DE NIVEL, FLOTADOR 8135-L
LSH 81212	INTERRUPTOR MAGNÉTICO DE NIVEL, BALÓN 8134-F
LSL 81212	INTERRUPTOR MAGNÉTICO DE NIVEL, BALÓN 8134-F
LSLL 81212	INTERRUPTOR MAGNÉTICO DE NIVEL, BALÓN 8134-F
LSH 81236	INTERRUPTOR MAGNÉTICO DE NIVEL, BALÓN 8139-F
LSH 81236	INTERRUPTOR MAGNÉTICO DE NIVEL, BALÓN 8139-F
LSH 81236	INTERRUPTOR MAGNÉTICO DE NIVEL, BALÓN 8139-F
FI 81213	CAUDALÍMETRO ELECTROMAGNÉTICO, BALÓN 8134-F
FI 81242	CAUDALÍMETRO ELECTROMAGNÉTICO, BALÓN 8139-F
LSH 81220	RELÉ DE SENSOR ULTRASONIDO, FOSA DE ESPUMAS 8132-J
LSL 81220	RELÉ DE SENSOR ULTRASONIDO, FOSA DE ESPUMAS 8132-J
LSLL 81220	RELÉ DE SENSOR ULTRASONIDO, FOSA DE ESPUMAS 8132-J
LSH 81244	RELÉ DE SENSOR ULTRASONIDO, FOSA DE ESPUMAS 8137-J
LSL 81244	RELÉ DE SENSOR ULTRASONIDO, FOSA DE ESPUMAS 8137-J
LSLL 81244	RELÉ DE SENSOR ULTRASONIDO, FOSA DE ESPUMAS 8137-J
XV-81215	VALV. MARIP. AUTOM., PURGA FLOTADOR 8130-L
YV-81216	SOLENOIDE EN LÍNEA, BALÓN 8134-F
YV-81217	SOLENOIDE EN LÍNEA, BALÓN 8134-F
XV-81218	VALV. MARIP. AUTOM., PRESURIZ. FLOTADOR 8130-L
XV-81219	VALV. MARIP. AUTOM., PRESURIZ. FLOTADOR 8130-L
XV-81239	VALV. MARIP. AUTOM., PURGA FLOTADOR 8135-L
YV-81240	SOLENOIDE EN LÍNEA, BALÓN 8139-F
YV-81241	SOLENOIDE EN LÍNEA, BALÓN 8139-F
XV-81242	VALV. MARIP. AUTOM., PRESURIZ. FLOTADOR 8135-L
XV-81243	VALV. MARIP. AUTOM., PRESURIZ. FLOTADOR 8135-L

OPERACIÓN DESDE TABLERO Y CONSOLA

En el tablero hay dos clases de equipos:

1) Equipos que poseen opción manual-off: son los agitadores de productos químicos, y los compresores
   a) Al ser colocados en manual, los agitadores responden al comando mediante botonera a pie de equipo
   b) En manual, los compresores arrancan y paran según presostato interno
2) Equipos con posición manual-off-auto
   a) Al colocarse en manual, arrancan y paran mediante botonera a pie de equipo
   b) Al ser colocados en off, el equipo no responde a botonera y el PLC no lo considera dentro del automatismo
   c) Al ser colocados en auto, arrancan y paran por orden del PLC según el automatismo. ATENCIÓN: si un equipo que esté funcionando en automático es detenido mediante parada de emergencia a pie de equipo, para reestablecer el equipo se debe
      i) Quitar la parada de emergencia (a pie de equipo)
      ii) Desde tablero, pasar la llave a la posición "off" y luego volverla a automático
      iii) Si el equipo tiene un equipo en stand-by colocado en automático, ese equipo habrá arrancado en cuanto se presionó la parada de emergencia, y volverá a conmutar a reestablecer el equipo en automático.

El tablero también cuenta con una consola tipo Magelis, desde la que se puede reconocer alarmas y modificar parámetros de proceso.

La Magelis cuenta con:

1) Pantalla de 2 líneas con 20 caracteres, donde aparecen los mensajes
2) Botones con flechas y teclas MOD, ESC, SHIFT y ENTER, utilizadas para la navegación por los distinto menús
3) Teclado numérico, para ingreso de valores
4) Teclas de función (F1 a F12): no se utilizan en este caso.

Se puede acceder a dos menús:

1) Menú principal: de aquí se accede a los distintos submenús de parámetros de planta. Si hubiera alguna alarma activa (Led "ALARM" encendido) se puede saltar al menú de alarmas presionando SHIFT+ENTER.
2) Menú de alarmas: este menú permite navegar entre las alarmas activas y reconocerlas. Se puede volver al menú principal presionando ESC.

Menú principal

El menú principal se navega mediante las flechas "arriba" y "abajo". Se ingresa al submenú deseado mediante la flecha "derecha". En el submenú, se navega entre las distintas opciones mediante las flechas "arriba" y "abajo". Para modificar el parámetro elegido, se presiona la tecla MOD y se escribe el valor deseado (para valores numéricos), o se cambia de estado mediante las flechas "arriba" y "abajo" (para los valores on-off).

El árbol de submenús es

MENÙ PRINCIPAL
- STOP BOCINA
  - STOP BOCINA ON/OFF
- MODIFICACIÓN TIEMPO VÁLVULA DE PURGA
  - TIEMPO VÁLVULA ABIERTA (segundos)
  - TIEMPO VÁLVULA CERRADA (segundo)
- PUESTA EN MARCHA FLOTADOR 1
  - PUESTA EN MARCHA DEL FLOTADOR 1 ON/OFF
- SETEO DE TIEMPOS FLOTADOR 1
  - TIEMPO DE LLENADO (segundos)
  - TIEMPO DE DETENCIÓN DE AIRE (segundos)
  - TIEMPO DE ENTRADA DE AIRE (segundo)
  - TIEMPO DE DESCOMPRESIÓN (segundos)
- PUESTA EN MARCHA FLOTADOR 2
  - PUESTA EN MARCHA DEL FLOTADOR 2ON/OFF
- SETEO DE TIEMPOS FLOTADOR 2
  - TIEMPO DE LLENADO (segundos)
  - TIEMPO DE DETENCIÓN DE AIRE (segundos)
  - TIEMPO DE ENTRADA DE AIRE (segundo)
  - TIEMPO DE DESCOMPRESIÓN (segundos)
- OPERACIÓN DE VÁLVULAS FLOTADOR 1 Y 2
  - YV-81216 (NORMAL/FORZAR ABRIR)
  - YV-81217(NORMAL/FORZAR ABRIR)
  - XV-81218 (NORMAL/FORZAR ABRIR)
  - XV-81219(NORMAL/FORZAR ABRIR)
  - YV-81240 (NORMAL/FORZAR ABRIR)
  - YV-81241(NORMAL/FORZAR ABRIR)
  - XV-81242 (NORMAL/FORZAR ABRIR)
  - XV-81243(NORMAL/FORZAR ABRIR)

La opción de apagar la bocina fue instalada en caso que se desee, en un futuro, cablear una alarma al tablero.

El tiempo de la válvula de purga de lodos XV-81215 y XV-81239 indica el tiempo, en segundos, que la válvula permanece abierta o cerrada (la válvula abre y cierra en forma cíclica). El parámetro es el mismo para ambos flotadores.

La puesta en marcha de cada flotador permite arrancar el sistema de presurización. Los sistemas funcionan en forma independiente, como así también son independientes los seteos de tiempos.

El menú de operación de válvulas permite forzar las solenoides y electroválvulas del proceso. Todas son NC, por lo que forzarlas las abre. Notar que si, por automatismo, la válvula en cuestión ya está abierta, forzarla no causa ningún efecto.

Menú de alarmas

En caso de haber por lo menos una alarma activa, estará activo el menú de alarmas. En este menú, se refleja la siguiente información:

1) Línea superior de la consola
   a) Fecha y hora de la ocurrencia de la alarma, o de su reconocimiento (ver más adelante)
   b) Número de alarma: en caso varias alarmas, se muestra el número de la alarma y su orden respectivo. Por ejemplo, de haber 4 alarmas y visualizarse la tercera, el display muestra ¾. Las distintas alarmas pueden navegarse con las flechas "derecha" e "izquierda".
2) Línea inferior: descripción de la falla. A veces el texto no cabe en una sola línea, en este caso puede visualizarse el texto faltante con la flecha "abajo". Si el texto está titilando, significa que la alarma aún no fue reconocida. En ese caso, la fecha y hora mostrada es la de ocurrencia de la falla. Al reconocerse la alarma (mediante la tecla ENTER) el texto queda fijo, y la fecha y hora son los de reconocimiento.

Para que una alarma desaparezca deben suceder dos cosas

1) Se debe reconocer la alarma
2) Se debe solucionar la causa de la alarma.

De ocurrir ambas cosas, la alarma desaparece. La consola no tiene registro histórico de alarmas.

LISTADO DE ALARMAS

Alarmas por fallas de equipo: en todo momento que el automatismo intente dar arranque a un equipo y dicho equipo no arranque, se genera mensaje de falla "FALLA EQUIPO XXYY", siendo XXYY el nombre y tag del equipo.

La imposibilidad de arrancar puede deberse a distintas causas: falla eléctrica y/o mecánica, parada de emergencia, etc.

Alarmas por niveles: en caso de producirse un nivel demasiado alto o demasiado bajo, se genera mensaje de alarma en la consola.

Nivel muy alto: en piletas API
Nivel muy bajo: en pileta API, en fosas de espumas, en flotadores (en la toma de bombas de presurización), en los tanques de reactivos.

Alarma por sólo una bomba en auto: la operación normal de la planta requiere que en la pileta API haya al menos dos bombas elevadoras seteadas en automático (de colocarse 3 bombas en auto, la tercera queda en stand-by). Si se coloca sólo 1 bomba elevadora en automático, el automatismo trabaja con esta bomba pero emite mensaje de alarma en consola.

SISTEMA DE PRESURIZACIÓN - DETALLE

IMPORTANTE

A continuación se describen las tareas para la realización de la primera puesta en marcha del sistema. Por lo tanto, son descripciones genéricas, y los valores citados son sólo parámetros de referencia. Esta descripción es útil en caso de querer optimizar la planta, o en caso de un desajuste serio que obligue a poner en marcha la planta de nuevo.

Los parámetros específicos utilizados durante la puesta en marcha de Noviembre del 2001, referirse al apartado "Parámetros de funcionamiento¨.

DESCRIPCION GENERAL

El flotador

Los flotadores ONDEO-DEGREMONT se componen siempre de cuatro sub-conjuntos.

1) Un sub-conjunto de disolución del aire en el agua: es el reactor de disolución de aire de presurización (Balón de presurización).
2) Un sub-conjunto de generación de micro burbujas: es la línea de descompresión.
3) Un sub-conjunto que realiza la mezcla íntima de las micro burbujas con las partículas: es el (o los) recipiente(s) de mezcla del flotador, situado en la base del equipo.
4) Un sub-conjunto de separación del agua y de las partículas sólidas: es el flotador propiamente dicho.

El capítulo trata únicamente los dos primeros sub-conjuntos.

La presurización – descompresión

- El principio consiste en disolver aire en agua a presión para liberar, después de la descompresión, cantidades de aire relativamente importantes bajo la forma de micro burbujas.
- Su realización pone en funcionamiento:
  - Un bombeo de alimentación del Balón en agua.
  - Un balón de contacto aire-agua con una regulación del nivel de agua.
  - Una(s) línea(s) equipada(s) con un sistema de descompresión que genera micro burbujas.

Balón de presurización

- La disolución realizada en el balón o reactor de disolución se caracteriza por:
  - Una presión de trabajo entre unos 4 y 6 bar.
  - Una superficie específica importante aire/agua.
  - Una interfaz aire/agua mantenida a nivel constante.

Regulación de nivel

Se describe en "Puesta a punto de la regulación de nivel".

Descompresión

El rol de la descompresión es el de realizar el paso de agua presurizada de unos 4-6 bar a la presión atmosférica con generación simultánea de micro burbujas (40 a 60 µm) en la masa líquida.

En este caso, la descompresión es tipo DD (doble descompresión, flotadores circulares) constituida por 2 válvulas en serie que aseguran una descompresión escalonada. La regulación consiste en repartir de manera adecuada, entre las dos válvulas, la pérdida de carga de la descompresión.

VERIFICACIONES EN PUESTA EN MARCHA

Bombeo

- Controlar el sentido de rotación.
- Controlar y limpiar las cañerías.

Balón de presurización

- Controlar que los agujeros del tubo de distribución de agua estén bien dirigidos hacia arriba, y medir su diámetro.
- En caudal máximo, la velocidad en las toberas o agujeros debe estar comprendida entre 6 y 9 m/s. Además, la velocidad no debe ser nunca inferior a 4 m/s (por ejemplo en el caso de un segundo caudal menor).
- Controlar la línea de aire comprimido.
- Controlar el reductor de presión específico (conjunto de regulación y filtro a la salida del compresor).
- Controlar y limpiar el balón.

OPERACIONES PRELIMINARES

Después de haberse asegurado que todas las cañerías y el balón estén limpios:

- Llenar el flotador.
- Poner en servicio el aire comprimido, controlar el buen funcionamiento del sistema (compresor, presóstato, reserva aire fábrica, etc.).
- Presurizar el balón para controlar su estanqueidad.
- Controlar que la válvula de seguridad actúe entre 6 y 7 bar. Descomprimir.

PUESTA A PUNTO DE LA REGULACION DE NIVEL

El arranque y la fijación de la regulación son específicos de cada tipo de balón y de la regulación. Los flotadores ONDEO Degrémont poseen:

1) Tres tipos de balón de presurización (tipo S, tipo L o tipo N). Esta planta en particular tiene un balón tipo S.
2) Tres tipos de regulación (tipo 1, tipo 2, tipo 3). Esta planta es tipo 3.

3) Dos tipos de despresurización (tipo DD, tipo DS). Esta planta es tipo DD.

Regulación tipo 1 – Regulación On/Off del aire

Principio

La regulación está asegurada por la abertura y el cierre de la electroválvula de alimentación de aire comprimido del balón, piloteada por los captadores LSH, LSL:

- Nivel alto LSH: abertura de la válvula de alimentación de aire YV-81216/40, la presión dentro del balón sube y el nivel baja.
- Nivel bajo LSL: cierre de la válvula de alimentación de aire YV-81216/40, el nivel sube por absorción de aire.
- Nivel muy bajo LSLL: cierre de la válvula de la línea de despresurización XV-81218/19/42/43, luego detención de la presurización.

Control del sistema, previo a la primera puesta en marcha.

El objetivo es controlar el buen funcionamiento de la regulación.

1) Llenado del balón
   a) Asegurarse que el flotador y la toma de agua de las bombas de presurización está lleno de agua.
   b) Abrir la purga de aire del balón.
   c) Cerrar las válvulas de descompresión.
   d) Arrancar el sistema de presurización en automático.
   e) Abrir un poco la válvula de regulación de caudal colocada en la impulsión.
2) Verificación 1
   a) Con el balón vacío, la electroválvula de alimentación de aire YV-81216/40 debe estar cerrada, lo mismo que la válvula de salida del balón XV-81218/19/42/43 y la válvula de puesta en la atmósfera.
3) Verificación 2
   a) El nivel sube.
   b) Una vez que se ha alcanzado el nivel LSLL, se debe abrir la válvula XV-81218/19/42/43.
   c) Una vez que se ha alcanzado el nivel LSH, se debe abrir la electroválvula YV-81216/40.
4) Verificación 3
   a) Hacer descender el nivel abriendo la válvula de vaciado del balón o abriendo parcialmente las válvulas de descompresión.
   b) En el nivel LSL, la electroválvula válvula YV-81216/40 debe cerrarse.
   c) En el nivel LSLL, la válvula XV-81218/19/42/43 debe cerrarse y la bomba de presurización debe detenerse. La alarma se activa y la abertura de la válvula YV-81217/41 descomprime el balón.

Regulación de la presión de aire

La presión del reductor de presión de aire está regulada en 0,5 bar como mínimo por encima de la presión de trabajo (presión balón).

Arranque automático y regulación

Caso de una descompresión doble tipo DD

- El balón está vacío.
- Cerrar la válvula manual de purga de aire.
- La válvula de regulación de caudal permanece un poco abierta (llenado del balón en más de un minuto...).
- Abrir las válvulas manuales de la línea de la descompresión doble.
- Arrancar en automático.
- Las cañerías y el balón se llenan lentamente con poca presión.
- El nivel se estabiliza antes o en el nivel de regulación.
- Abrir la válvula de regulación de caudal.
- Regular las 2 válvulas de descompresión para obtener el caudal nominal (ver "Regulación de la descompresión").
- Si el caudal no puede ser alcanzado, abrir más la válvula de regulación de caudal.
- Ajustar el reductor de presión de aire (al menos 0.5 bar encima de la presión de trabajo del balón).
- Volver a regular la línea de descompresión si fuera necesario.

Verificación del automatismo

- Detener y volver a poner en funcionamiento la presurización.
- Controlar que:
  - Las secuencias de funcionamiento y la posición de las válvulas estén conformes con el GRAFCET del esquema de funcionamiento de módulos de presurización.
  - En detención, el nivel de agua en el balón esté a nivel o por debajo del captador LSLL.
  - El nuevo arranque se haga sin sacudidas (puesta en equilibrio en más de 5 segundos).

REGULACION DE LAS LINEAS DE DESCOMPRESION

Línea con descompresión doble tipo DD

- La regulación se realiza durante la fase de arranque automático – ver "arranque en automático y regulación".
- El conjunto de la presurización está en funcionamiento automático, en equilibrio pero con cualquier caudal.

Las operaciones a realizar son las siguientes:

Estado inicial

- La válvula de compuerta está un poco abierta.
- La válvula de manguito o a diafragma está abierta.

Primera regulación

a) Control por caudalímetro

Acciones

- Abrir lentamente la válvula de compuerta y ajustar el caudal en el valor QP1 igual a 1,5 o 2 veces el caudal de presurización previsto QP (para esta planta, QP=75m3/h).
- Cerrar progresivamente la válvula a diafragma hasta obtener el caudal previsto.

Verificaciones

- Si la válvula a diafragma comienza a vibrar (frecuente con la válvula de manguito) volver a comenzar la operación reduciendo el valor QP1, es decir, cerrando más la válvula de compuerta (QP1 debe ser siempre superior a 1,20 QP).
- Un silbido importante en una de las válvulas significa un cierre demasiado importante: volver a iniciar la operación abriendo más la válvula. Buena regulación con ruido mínimo en la cañería.

Características de la regulación: la relación a = QP1/QP es la referencia de la regulación. Es necesario anotarla para poder reproducir la regulación.

b) Control por manómetro y caudalímetro

La regulación siguiente puede realizarse si se coloca un manómetro entre las dos válvulas de descompresión:

Acciones

A caudal nominal, ajustar las válvulas de manera tal que las pérdidas de carga en la válvula de compuerta (ΔH1 y en la segunda válvula a diafragma (ΔH2) se repartan a priori de la siguiente manera[2]:

$0{,}25\ \Delta H < \Delta H1 < 0{,}4\ \Delta H$

$0{,}60\ \Delta H < \Delta H2 < 0{,}75\ \Delta H$

ΔH es la pérdida de carga total

(ΔH = presión balón - altura de agua por encima de la presurización)

Verificaciones

- Ninguna vibración de la válvula a diafragma
- Ningún silbido importante a nivel de la válvula.

[2] Importante: este es el procedimiento general, referirse a los valores del apartado "Parámetros de funcionamiento" para verificar los valores utilizados en la puesta en marcha de Noviembre de 2001.

Característica de la regulación: anotar el caudal QP, la presión entre válvulas y/o las pérdidas de carga ΔH1 y ΔH2.

Control de la regulación

- Verificar la calidad de la nube de micro burbujas en el flotador (aspecto lechoso en toda la superficie).
- Retomar la regulación si hay:
  - algunas burbujas de diámetro superior al cm.
  - muchas burbujas de diámetro superior al mm.

  No confundir con la espuma normal producida en el efluente por la turbulencia. Para estimar esta espuma, bastará detener el sistema de presurización y observar la espuma que se forma en el flotador cuando ingresa efluente pero no hay presurización.
- En la mayoría de los casos, bastará con disipar más presión en la segunda válvula (ΔH2 más grande o aumentar QP1).

PUESTA EN MARCHA Y PARADA

En este apartado se describe el arranque y parada normales, (por mantenimiento p. Ej.) del sistema de presurización.

Arranque

El arranque se realiza directamente en forma automática, mediante la consola. Antes se deberá controlar que:

- Las válvulas de aislación de las bombas y la válvula de alimentación de aire comprimido estén abiertas.
- La válvula de puesta en la atmósfera y la válvula de vaciado estén cerradas.
- El sistema de aire comprimido esté en servicio y las válvulas y el balón de presurización sean alimentados.
- El flotador o la columna de equilibrio estén en agua.

Parada

En una parada, el balón debe ser dejado en el estado en que lo dejó el automatismo. No se aconseja vaciarlo completamente fuera de la operación de mantenimiento.

CONTROL Y REGULACION

Se procederá regularmente a los siguientes controles:

Nivel de regulación

- Controlar que esté estable y siempre en la misma cota.
- Si varía:
  - Controlar y limpiar los captadores
  - Controlar la regulación de la descompresión
  - Controlar la regulación de la válvula de ajuste de la bomba de presurización.

Seguridad baja (y alta)

- Una vez por año (o varias veces si es posible) es necesario controlar que los captadores sigan siendo operativos, forzando voluntariamente el nivel en el balón hasta los niveles LSLL y LSHH.

Presión en el balón

Controlar el regulador de presión (a la salida del compresor) y si fuera necesario, ajustarlo.

Regulación de las válvulas de descompresión

- ***No cambiar la regulación después de la puesta en marcha.***

- Si hay un desajuste, volver a regular siguiendo las especificaciones de la puesta en marcha.

Calidad de las microburbujas

- La nube de micro burbujas debe tener el aspecto de una leche blanca. No debe haber prácticamente burbujas grandes (d ≥ 10 mm.) ni demasiadas burbujas medianas (d ≥ 1 mm.).
- Si no es el caso, referirse al cuadro "incidentes", para mejorar la situación.

MANTENIMIENTO

Elementos mecánicos

Asegurar periódicamente el mantenimiento de las bombas, de las válvulas, etc. (ver manuales de los constructores). ***Seguir las instrucciones para un efectivo mantenimiento de la garantía.***

Balón de presurización, balón de aire comprimido

En ciertos casos, es necesario limpiarlos periódicamente. Vaciar el balón, remover la brida de inspección y lavar con agua a presión.

INCIDENTES

Los principales incidentes, sus causas y sus remedios, se indican en el cuadro siguiente. Según las instalaciones o el tipo de tratamiento, se pueden realizar modificaciones o introducir complementos.

INCIDENTES	CAUSAS PROBABLES	ACCIONES
1. INCIDENTES MECANICOS Y ALARMAS		
1.1 La presurización no arranca	. parada como consecuencia de un defecto.	. poner en estado y resetear.
	. disfunción de la bomba de presurización.	. controlar y limpiar el filtro, eventualmente el cuerpo de la bomba.
	. nivel bajo en la aspiración de la bomba.	. falta de agua en el flotador o la columna de equilibrio: llenar.
		. controlar el cierre de las válvulas de vaciado del flotador y de la columna de equilibrio si la hubiere.
1.2 Alarmas de nivel del balón de presurización	. bomba de presurización.	. controlar la bomba, controlar que no esté tapada ni deteriorada.
. nivel muy bajo LSLL	. presión demasiado elevada en el balón.	. bajar la presión, controlar el estado del reductor de presión.
	. desajuste de la regulación de nivel.	. controlar los captadores.
	. desajuste de la línea de descompresión.	. controlar el caudal, regular.
	. falta de aire	. controlar el reductor de presión y el sistema de aire comprimido.
	. desajuste de la regulación de nivel.	. controlar los captadores.
. nivel muy alto LSHH	. desajuste de la línea de	

INCIDENTES	CAUSAS PROBABLES	ACCIONES
o LSH + tempo	descompresión. . taponamiento de la línea de descompresión.	. controlar el caudal, regular. . controlar el caudal, destapar: .. si descompresión tipo DD, abrir las válvulas de descompresión
2. INCIDENTES DE TRATAMIENTO		
2.1 Formación de grandes burbujas.	. sistema de descompresión desajustado.	. regular según las especificaciones de puesta en marcha. Mejora posible con mayor pérdida de carga en la segunda válvula de descompresión.
	. válvula de manguito o a diafragma deteriorada.	. si fuera necesario, cambiar el manguito.
	. válvula de aislación mal abierta o descentrada.	. abrir.
	. accidente después de la descompresión (codo, objeto en el recipiente de mezclado...)	. prever modificación o vaciado...
	. caudal de presurización mucho más importante de lo previsto.	. reducir el caudal.
2.2 Cantidad insuficiente de microburbujas.		
	. caudal de presurización demasiado débil.	. aumentar el caudal, controlar si el bombeo es suficiente.
	. presión demasiado débil en el balón de presurización.	. aumentar la presión.
	. poco rendimiento de	

INCIDENTES	CAUSAS PROBABLES	ACCIONES
	disolución.	. controlar que las toberas o el (los) tubo(s) de distribución del balón hayan sido bien montados.
		. controlar la velocidad a la salida de las toberas. Si fuera necesario, colocar toberas más pequeñas.
	. subida del nivel de agua en el balón.	. ver alarma "nivel alto".

LISTA DE ELEMENTOS A COMANDAR

PLANO N° :5487-800/A

1. EQUIPO	2. FUNCIONAMIENTO	3. COMANDO	4. SEÑALIZACIÓN
Agitador coagulante Tag 8126-L / 8126-LA Cantidad: 2 Potencia: 0,55	Arranque Directo Simultaneidad. 2 equipos funcionando	Arranque/parada por botonera a pie de equipo	En CCM Verde: marcha Rojo: detenido
Bomba dosificadora de coagulante Tag: 8128-J / 8128-JA Cantidad: 2 Potencia:	Arranque Directo Simultaneidad. 1 marcha + 1 stand-by Enclavamientos de seguridad LSL 81202 ó LSL 81203, seleccionable mediante selectora cuba A/cuba B a pie de equipo (habilita el switch de bajo nivel de la cuba seleccionada)	CCM: Llave M-O-A A pie de equipo: botonera de arranque y parada (parada tipo golpe de puño c/retención), y selectora cuba A/B En manual: arranque y parada por botonera a pie de equipo En auto: arranque y parada por orden del PLC, y parada por botonera a pie de equipo	En CCM Verde: marcha Rojo: detenido

1. EQUIPO	2. FUNCIONAMIENTO	3. COMANDO	4. SEÑALIZACIÓN
Agitador floculante Tag 8127-L / 8127-LA Cantidad: 2 Potencia: 0,55	Arranque Directo Simultaneidad. 2 equipos funcionando	Arranque/parada por botonera a pie de equipo	En CCM Verde: marcha Rojo: detenido
Bomba dosificadora de floculante Tag: 8129-J / 8129-JA Cantidad: 2 Potencia:	Arranque Directo Simultaneidad. 1 marcha + 1 stand-by Enclavamientos de seguridad LSL 81204 ó LSL 81205, seleccionable mediante selectora cuba A/cuba B a pie de equipo (habilita el switch de bajo nivel de la cuba seleccionada)	CCM: Llave M-O-A A pie de equipo: botonera de arranque y parada (parada tipo golpe de puño c/retención), y selectora cuba A/B En manual: arranque y parada por botonera a pie de equipo En auto: arranque y parada por orden del PLC, y parada por botonera a pie de equipo	En CCM Verde: marcha Rojo: detenido

1. EQUIPO	2. FUNCIONAMIENTO	3. COMANDO	4. SEÑALIZACIÓN
Bombas elevadoras pileta API Tag: 8121-J / 8122-J 8123-J Cantidad: 3 Potencia:16	<u>Arranque</u> Estrella/triángulo <u>Simultaneidad.</u> 2 marcha + 1 stand-by <u>Enclavamientos de seguridad</u> LSL 81201 bajo nivel en en pileta API TSH 8121-J Contacto de temperatura (interno 8121-J) TSH 8122-J Contacto de temperatura (interno 8122-J) TSH 8123-J Contacto de temperatura (interno 8123-J) XSH 8121-J Contacto de humedad (interno 8121-J) XSH 8122-J Contacto de humedad (interno 8122-J) XSH 8123-J Contacto de humedad (interno 8123-J) LSL 81201 enclava a todas las bombas Los contactos internos enclavan sólo a la bomba propia	CCM: Llave M-O-A A pie de equipo: botonera de arranque y parada (parada tipo golpe de puño c/retención) En manual: arranque y parada por botonera a pie de equipo En auto: arranque y parada por orden del PLC, y parada por botonera a pie de equipo	En CCM Verde: marcha Rojo: detenido
Agitador rápido Tag: 8124-L Cantidad: 1 Potencia:11	<u>Arranque</u> Directo, a través de variador de frecuencia <u>Simultaneidad.</u> 1 marcha + <u>Enclavamientos de seguridad</u>	CCM: Llave M-O-A A pie de equipo: botonera de arranque y parada (parada tipo golpe de puño c/retención) En manual: arranque y parada por botonera a pie de equipo En auto: arranque y parada por orden del	En CCM Verde: marcha Rojo: detenido

		PLC, y parada por botonera a pie de equipo	

1. EQUIPO	**2. FUNCIONAMIENTO**	**3. COMANDO**	**4. SEÑALIZACIÓN**
Floculador Tag: 8125-L Cantidad: 1 Potencia:1,5	<u>Arranque</u> Directo <u>Simultaneidad.</u> 1 marcha + <u>Enclavamientos de seguridad</u>	CCM: Llave M-O-A A pie de equipo: botonera de arranque y parada (parada tipo golpe de puño c/retención) En manual: arranque y parada por botonera a pie de equipo En auto: arranque y parada por orden del PLC, y parada por botonera a pie de equipo	En CCM Verde: marcha Rojo: detenido
Bombas de presurización Tag: 8131-J / 8131-JA 8136-J / 8136-JA Cantidad: 4 Potencia:37	<u>Arranque</u> Estrella/Triángulo <u>Simultaneidad.</u> 2 marcha + 2 stand-by <u>Enclavamientos de seguridad</u> LSL 81207 bajo nivel flotador I, enclava 8131-J y 8131-JA LSL 81231 bajo nivel flotador I, enclava 8136-J y 8136-JA	CCM: Llave M-O-A A pie de equipo: botonera de arranque y parada (parada tipo golpe de puño c/retención) En manual: arranque y parada por botonera a pie de equipo En auto: arranque y parada por orden del	En CCM Verde: marcha Rojo: detenido

		PLC, y parada por botonera a pie de equipo	

1. EQUIPO	**2. FUNCIONAMIENTO**	**3. COMANDO**	**4. SEÑALIZACIÓN**
Puente barredor Tag: 8130-L / 8135-L Cantidad: 2 Potencia: 0,25	<u>Arranque</u> Directo <u>Simultaneidad.</u> 2 marcha + <u>Enclavamientos de seguridad</u> XSH 81206 Sensor de torque, enclava 8130-L XSH 81230 Sensor de torque, enclava 8135-L	CCM: Llave M-O-A A pie de equipo: botonera de arranque y parada (parada tipo golpe de puño c/retención) En manual: arranque y parada por botonera a pie de equipo En auto: arranque y parada por orden del PLC, y parada por botonera a pie de equipo	En CCM Verde: marcha Rojo: detenido
Bombas de flotantes Tag: 8132-J / 8137-J Cantidad: 2 Potencia:1,4	<u>Arranque</u> Directo <u>Simultaneidad.</u> 2 marcha + <u>Enclavamientos de seguridad</u> LSL 81220 Muy bajo nivel en cuba (dado por FT 81220) LSL 81244 Muy bajo nivel en cuba (dado por FT 81244)	CCM: Llave M-O-A A pie de equipo: botonera de arranque y parada (parada tipo golpe de puño c/retención) En manual: arranque y parada por botonera a pie de equipo En auto: arranque y	En CCM Verde: marcha Rojo: detenido

		parada por orden del PLC, y parada por botonera a pie de equipo	

1. EQUIPO	**2. FUNCIONAMIENTO**	**3. COMANDO**	**4. SEÑALIZACIÓN**
Compresor Tag: 8133-J / 8138-J Cantidad: 2 Potencia:2,2	<u>Arranque</u> Directo c/presostato del equipo <u>Simultaneidad.</u> 2 marcha + <u>Enclavamientos de seguridad</u>	CCM: Llave Si/No	En CCM Verde: marcha Rojo: detenido
Compuerta Tag: Cantidad: 1 Potencia:	<u>Arranque</u> Directo <u>Simultaneidad.</u> 1 marcha + <u>Enclavamientos de seguridad</u> Torque Límites de carrera Abierto y Cerrado		En CCM Verde: marcha Rojo: detenido

LISTA DE ELEMENTOS A COMANDAR

PLANO N° :5487-800/A

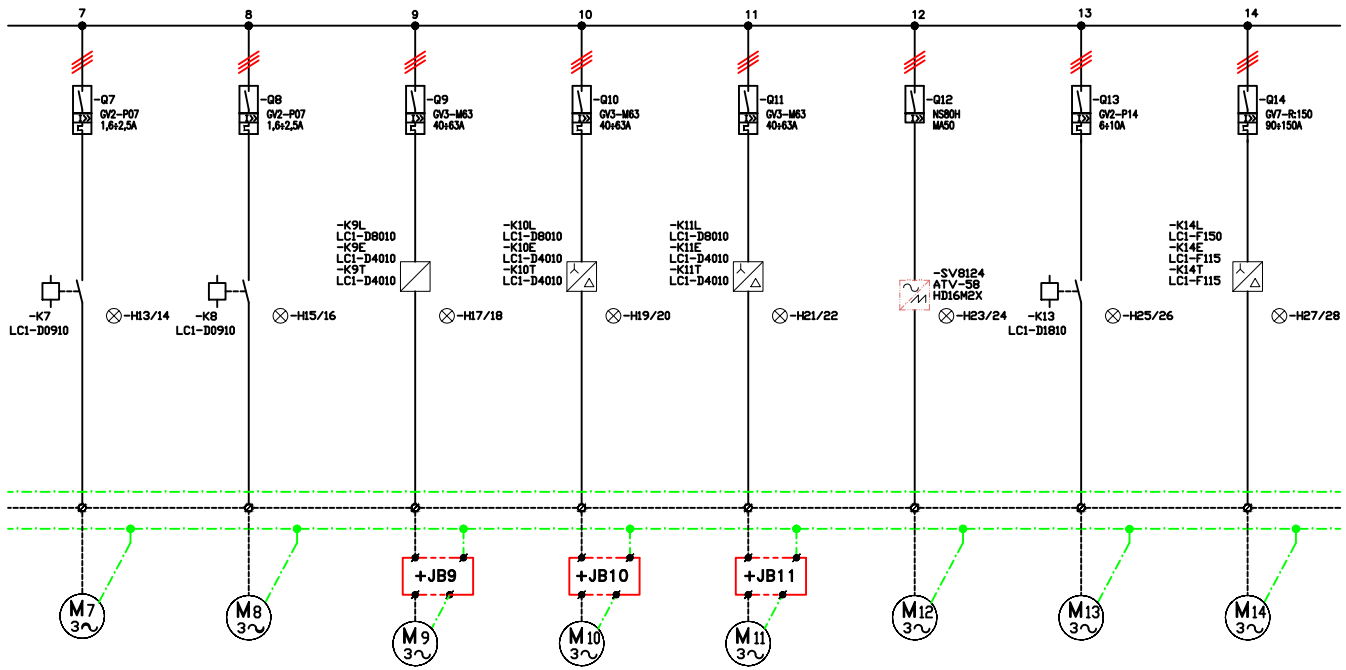
Hoja: 7 De: 8



LISTA DE ELEMENTOS A COMANDAR

PLANO N° :5487-800/A

1. ALARMAS	2. CAUSA	3. ORIGEN	4. SEÑALIZACIÓN
LSHH 81201	Muy alto nivel pileta API	LSHH 81201	
LSLL 81201	Muy bajo nivel pileta API	LSLL 81201	
LAL 81202	Bajo nivel coagulante	LSL 81202	
	(LSL seleccionable por Hand Switch)	LSL 81203	
LAL 81204	Bajo nivel floculante	LSL 81204	
	(LSL seleccionable por Hand Switch)	LSL 81205	
XAH 81206	Torque elevado flotador I	XSH 81206	
XAH 81230	Torque elevado flotador II	XSH 81230	Alarma sonora Identificación de alarma a través de consola de operación en el tablero
LSL 81207	Bajo nivel en flotador I	LSL 81207	
LSL 81231	Bajo nivel en flotador II	LSL 81231	
TAH 8121-J	Alta temperatura bomba 8121-J	TSH 8121-J	
TAH 8122-J	Alta temperatura bomba 8122-J	TSH 8122-J	
TAH 8123-J	Alta temperatura bomba 8123-J	TSH 8123-J	
MAH 8121-J	Humedad bomba 8121-J	XSH 8121-J	
MAH 8122-J	Humedad bomba 8122-J	XSH 8122-J	
MAH 8123-J	Humedad bomba 8123-J	XSH 8123-J	
LALL 81220	Muy bajo nivel bomba de flotantes 8132-J	LSLL 81220	
LALL 81244	Muy bajo nivel bomba de flotantes 8137-J	LSLL 81244	
torque elevado		Torque compuerta	
PAL 81209	Presión muy alta compresor 8133-J	PSL 81209	
PAL 81233	Presión muy alta compresor 8133-J	PSL 81233	



R7 S7 T7	R8 S8 T8	U9 V9 W9 X9 Y9 Z9	U10 V10 W10 X10 Y10 Z10	U11 V11 W11 X11 Y11 Z11	R12 S12 T12	R13 S13 T13	U14 V14 W14 X14 Y14 Z14
0,37	0,37	16	16	16	11	1,5	37
1,8	1,8	55,5	55,5	55,5	39	6,1	126
BOMBA DOSIFICADORA FLOCULANTE	BOMBA DOSIFICADORA FLOCULANTE	BOMBA ELEVADORAS PILETA API	BOMBA ELEVADORAS PILETA API	BOMBA ELEVADORAS PILETA API	AGITADOR RAPIDO	FLOCULADOR	BOMBA PRESURIZACION
8129-J	8129-JA	8121-J	8122-J	8123-J	8124-L	8125-L	8131-J

QUEDA PROHIBIDA LA REPRODUCCION TOTAL O PARCIAL DE ESTE DOCUMENTO SIN PREVIA AUTORIZACION ESCRITA DE DEGREMONT S.A. - PROPIEDAD DE DEGREMONT S.A. -

DOCUMENTO DISEÑADO POR ORDENADOR
FORMATO : 420 mm x 297 mm

DISK Nº: 01 ARCHIVO: 5487-801-D.dwg

Degrémont TRATAMIENTO DE AGUAS

PLANO Nº : 5487 – 801 D
EJECUCION NUMERO REV.

Fecha : 06 / 04 /2001
Realizo : CARAVANTE
HOJA 3 DE 5 HOJAS

A3

Plano 5487-900/A

Descripción de automatismo

Módulos DAF planta La Teja

Descripción de automatismo

A ser interpretada en conjunto con el P&I, plano 5487-001

Resumen del proceso

El efluente es elevado mediante las bombas **8121-J/8122-J/8123-J** hasta la cámara de agitación rápida, en la que se inyecta coagulante mediante las bombas **8128-J/8128-JA**. Luego pasa a la cámara de floculación donde se inyecta coagulante mediante las bombas **8129-J/8129/JA**.

De allí el efluente se divide en dos corrientes iguales, cada una de ellas tratada en uno de los flotadores. Cada flotador tiene asociado un sistema de presurización y disolución de aire, mediante las bombas **8131-J/8131-JA** y compresor **8133-J** para el flotador I, y , mediante las bombas **8136-J/8136-JA** y compresor **8138-J** para el flotador II.

El agua tratada se dirige por rebalse a la salida de planta. Las espumas separadas se recogen en las fosas de espumas y bombeadas a la fosa colectora de aceites por la bomba **8132-J** en el caso del flotador I, y por la bomba **8137-J** en el caso del flotador II.

Descripción detallada

1. ***Bombas de elevación*** **8121-J/8122-J/8123-J**
   - 1.1. Las bombas poseen en tablero selector Manual-0-Auto, y botonera a pie de equipo.
   - 1.2. Funcionamiento en **MANUAL**:
     - 1.2.1. La bomba arranca por botonera de arranque a pie de equipo
     - 1.2.2. La bomba se detiene por
       - 1.2.2.1. botonera a pie de equipo,
       - 1.2.2.2. muy bajo nivel en el canal de bombeo, señalizado por la pera **LSLL 81201** y dando alarma en tablero.
   - 1.3. Funcionamiento en **AUTOMÁTICO:**
     - 1.3.1. La filosofía de funcionamiento está pensada para dos bombas funcionando y la tercera en stand by, arrancando y parando según los niveles en el canal de bombeo de acuerdo al siguiente esquema

LS	Acción	
	Nivel en ascenso	Nivel en descenso
LSHH 81201	Alarma por muy alto nivel	-
LSH 81201	Arranca bomba "B"	-
LS 81201	Arranca bomba "A"	Detiene bomba "B"
LSL 81201	-	Detiene bomba "A"
LSLL 81201	-	Alarma por muy bajo nivel Parada de bombas

     - 1.3.2. Dependiendo cuántas bombas se coloquen en automático:
       - 1.3.2.1. <u>Tres bombas en automático</u>:
         - 1.3.2.1.1. El PLC selecciona una de las bombas como bomba “A”, otra como bomba “B” y otra como bomba “stand-by”
         - 1.3.2.1.2. Las bombas “A” y “B” arrancan y se detienen según el esquema 1.3.1
         - 1.3.2.1.3. Al detenerse la bomba “A”, el PLC rota las bombas para que
           - 1.3.2.1.3.1. Bomba “A” pasa a ser bomba “B”
           - 1.3.2.1.3.2. Bomba “B” pasa a ser bomba “stand-by”

1.3.2.1.3.3. Bomba “stand-by” pasa a ser bomba “A”
1.3.2.1.4. En caso de falla de una de las bombas
1.3.2.1.4.1. Se detiene la bomba en falla, con alarma en tablero
1.3.2.1.4.2. La bomba en “stand-by” toma el rol de la bomba detenida
1.3.2.1.4.3. El funcionamiento es según el punto 1.3.2.2. (dos bombas en auto)
1.3.2.2. Dos bombas en automático:
1.3.2.2.1. El PLC selecciona una de las bombas como bomba “A” y la otra como bomba “B”.
1.3.2.2.2. Las bombas “A” y “B” arrancan y se detienen según el esquema 1.3.1
1.3.2.2.3. Al detenerse la bomba “A”, el PLC rota las bombas para que
1.3.2.2.3.1. Bomba “A” pasa a ser bomba “B”
1.3.2.2.3.2. Bomba “B” pasa a ser bomba “A”
1.3.2.2.4. En caso de falla, el funcionamiento es según el punto 1.3.2.3. (Una bomba en auto)
1.3.2.3. Una bomba en auto:
1.3.2.3.1. Esta es una situación anormal, que debe reflejarse en la consola en tablero. La bomba funciona como bomba “A”

1.4. Independientemente de si están colocadas en manual o auto, las bombas se detienen por
1.4.1. Alta temperatura (sensor **TSH** interno a cada bomba), dando alarma por consola
1.4.2. Humedad interna (sensor **XSH** interno a cada bomba), dando alarma por consola.

2. ***Agitador y floculador*** 8124-L y 8125-L

2.1. Cada equipo posee en tablero selector Manual-0-Auto, y botonera a pie de equipo.
2.2. Funcionamiento en **MANUAL**:
2.2.1. Equipo arranca y para por botonera a pie de equipo
2.3. Funcionamiento en **AUTOMÁTICO:**
2.3.1. Los equipos arrancan al arrancar la bomba de elevación “A” (ver punton 1.3)
2.3.2. Los equipos se detienen
2.3.2.1. 15´ luego de detenida la bomba de elevación “A” (ver punto 1.3)
2.3.2.2. Por botonera a pie de equipo
2.4. El agitador **8124-L** arranca mediante variador de velocidad, que es programado en campo.

3. ***Dosificación coagulantes*** 8128-J/JA

3.1. Las bombas poseen en tablero selector Manual-0-Auto, y botonera a pie de equipo.
3.2. Funcionamiento en **MANUAL**:
3.2.1. La bomba arranca y detiene por botonera de arranque a pie de equipo
3.3. Funcionamiento en **AUTOMÁTICO:**
3.3.1. Dos bombas en automático
3.3.1.1. El PLC selecciona una bomba como “activa” y otra en “Stand-by”
3.3.1.2. La bomba “activa” prende y apaga junto con la bomba de elevación “A” (ver punto 1.3)
3.3.1.3. Al detenerse la bomba “activa”, el PLC rota las bombas “activa” y “stand-by”
3.3.1.4. En caso de falla de la bomba “activa”
3.3.1.4.1. Se da alarma en tablero
3.3.1.4.2. Se coloca la bomba “stand-by” como bomba “activa”
3.3.1.4.3. El fucionamiento es según 3.3.2 (una bomba en auto)
3.3.2. Una bomba en auto: la bomba arranca y para al mismo tiempo que la bomba de alimentación “A” (ver 1.3)
3.3.3. Independientemente de cuántas bombas estén en auto, se detienen en caso de bajo nivel en la cuba de producto químico (similar punto 3.2.2.2), dando alarma por tablero.
3.4. Tanto en manual como en auto, la bomba en funcionamiento se detiene por muy bajo nivel en cuba de reactivos. Dado que cada bomba puede tomar de dos cubas, se selecciona la cuba activa mediante el hand-switch **HS-81202,** para seleccionar **LSL-81202 o LSL-81203**.

4. ***Bombas de floculante*** **8129-JA**

4.1. El funcionamiento es idéntico a las bombas de coagulantes (ver punto 3.)

4.2. Los niveles en este caso son **LSL-81204 y LSL-81205**, seleccionable mediante hand-switch **HS-81204**

5. ***Bombas de espumas*** **8132-J/8137-J**

5.1. Las bombas poseen en tablero selector Manual-0-Auto, y botonera a pie de equipo.
5.2. Funcionamiento en **MANUAL**:
  5.2.1. La bomba arranca por botonera de arranque a pie de equipo
  5.2.2. La bomba se detiene por
    5.2.2.1. botonera a pie de equipo,
    5.2.2.2. muy bajo nivel **LSLL-81220** para la bomba **8132-J**, y **LSLL-81244** para la bomba **8137-J**, con alarma en tablero.
5.3. Funcionamiento en **AUTOMÁTICO:**
  5.3.1. La bomba **8132-J** arranca por alto nivel **LSH-81220,** y detiene por bajo nivel **LSL-81220.**
  5.3.2. La bomba **8137-J** arranca por alto nivel **LSH-81244,** y detiene por bajo nivel **LSL-81244.**
  5.3.3. Pueden detenerse mediante botonera a pie de equipo.

6. ***Barredores de superficie*** **8130-L/8135-L**

6.1. Los barredores poseen en tablero selector Manual-0-Auto, y botonera a pie de equipo.
6.2. Funcionamiento en **MANUAL**:
  6.2.1. El barredor es arrancado por botonera a pie de equipo
  6.2.2. El barredor se detiene por
    6.2.2.1. botonera a pie de equipo,
6.3. Funcionamiento en **AUTOMÁTICO:**
  6.3.1. El barredor arranca al ser colocado en automático.
  6.3.2. Se detiene por muy bajo nivel **LSL-81207** para el barredor **8130-L**, y **LSL-81231** para el barredor **8131-L** con alarma en tablero.
6.4. Tanto en auto como en manual, el barredor detiene por torque elevado con alarma en tablero (**XSH-81206** para **8130-L**, y **XSH-81230** para **8135-L**)

7. ***Purga de fondo de flotadores*** **XV-81215/XV81239**

7.1. Funcionan siempre en automático
  7.1.1. Mientras este en marcha al menos una bomba de elevación (ver punto 1.), tanto sea en manual o en automático, las válvulas realizan un ciclo de apertura-cierre compuesto de:
    7.1.1.1. Ambas válvulas permanecen abiertas un tiempo “t1” definible por consola en tablero, del rango de 0 a 600 segundos.
    7.1.1.2. Ambas válvulas permanecen cerradas un tiempo “t2” definible por consola, de 0 a 1800 segundos.
  7.1.2. Si todas las bombas de elevación están detenidas, las válvulas permanecen cerradas.

8. ***Sistema de presurización*** **flotador I**

8.1. El sistema de presurización está compuesto
  8.1.1. Bombas de presurización **8131-J/JA**
  8.1.2. Compresor **8133-J**
  8.1.3. Electroválvulas
    8.1.3.1. **YV-81216** (Alimentación de aire al balón de presurización)
    8.1.3.2. **YV-81217** (venteo a la atmósfera)
  8.1.4. Válvulas de salida de balón **XV-81218** y **XV-81219**
  8.1.5. Balón de presurización **8134-F**, con niveles
    8.1.5.1. **LSH-81212** (Nivel alto en balón)
    8.1.5.2. **LSL-81212** (Nivel bajo en balón)
    8.1.5.3. **LSLL-81212** (Nivel muy bajo en balón)
8.2. Las bombas de presurización **8131-J/JA** poseen en tablero selector Manual-0-Auto, y botonera a pie de equipo.
8.3. Funcionamiento en **MANUAL**:

8.3.1. La bomba arranca por botonera de arranque a pie de equipo
8.3.2. La bomba se detiene por
8.3.2.1. botonera a pie de equipo,
8.3.2.2. muy bajo nivel **LSL-81207**

8.4. Funcionamiento en **AUTOMÁTICO:** Responde al funcionamiento del sistema de presurización (Ver 8.6.). En caso de estar ambas bombas en automático sólo funciona una de ellas.
8.5. Las válvulas funcionan únicamente en automático.
8.6. Esquema de funcionamiento: Ver esquemas 5487-901a.

9. ***Sistema de presurización*** **flotador II**

9.1. El sistema de presurización está compuesto
9.1.1. Bombas de presurización **8136-J/JA**
9.1.2. Compresor **8138-J**
9.1.3. Electroválvulas
9.1.3.1. **YV-81240**(Alimentación de aire al balón de presurización)
9.1.3.2. **YV-81241** (venteo a la atmósfera)
9.1.4. Válvulas de salida de balón **XV-81242** y **XV-81243**
9.1.5. Balón de presurización **8139-F**, con niveles
9.1.5.1. **LSH-81236** (Nivel alto en balón)
9.1.5.2. **LSL-81236** (Nivel bajo en balón)
9.1.5.3. **LSLL-81236** (Nivel muy bajo en balón)

9.2. Las bombas de presurización **8136-J/JA** poseen en tablero selector Manual-0-Auto, y botonera a pie de equipo.
9.3. Funcionamiento en **MANUAL**:
9.3.1. La bomba arranca por botonera de arranque a pie de equipo
9.3.2. La bomba se detiene por
9.3.2.1. botonera a pie de equipo,
9.3.2.2. muy bajo nivel **LSL-81231**

9.4. Funcionamiento en **AUTOMÁTICO:** Responde al funcionamiento del sistema de presurización (Ver 9.6.). En caso de estar ambas bombas en automático sólo funciona una de ellas.
9.5. Las válvulas funcionan únicamente en automático.
9.6. Esquema de funcionamiento: Ver esquemas 5487-901a.

10. ***Operación por consola en tablero***

10.1. Mediante la consola en tablero debe poderse
10.1.1. Visualizar e identificar las alarmas activas, y reconocerlas
10.1.2. Apagar la alarma.
10.1.3. Modificación de los tiempos de operación
10.1.3.1. Tiempo de válvula de purga de fondos abierta (7.1.1.1.)
10.1.3.2. Tiempo de válvula de purga de fondos cerrada (7.1.1.2.)
10.1.3.3. Tiempos t1, t2, t3 y t4 del funcionamiento del sistema de presurización
10.1.4. Dar orden de marcha al sistema de presurización del flotador I
10.1.5. Dar orden de marcha al sistema de presurización del flotador II (ambos sistemas funcionan en forma independiente)
10.1.6. Forzar apertura de todas las electroválvulas y solenoides.

User Guide OI/TB84PH–EN Rev. C

Type TB84pH Advantage Series™ pH/ORP/pION transmitter



Power and productivity
for a better world™

WARNING notices as used in this manual apply to hazards or unsafe practices which could result in personal injury or death.
CAUTION notices apply to hazards or unsafe practices which could result in property damage.
NOTES highlight procedures and contain information which assist the operator in understanding the information contained in this manual.

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Preface

This publication is for the use of technical personnel responsible for installation, operation, and maintenance of the ABB Advantage Series TB84PH.

Where necessary, this publication is broken into sections detailing the differences between analyzers configured as pH, ORP, or pION. In addition, the configuration section will give a detailed overview of all analyzer functions and how these functions have been grouped into the two major configuration modes: Basic and Advanced.

The Series TB84PH analyzer is delivered with default hardware and software configurations as shown in the table below. These settings may need to be changed depending on the application requirements.

Factory Default Settings

Software		Hardware	
Instrument Mode:	Basic	**Power Supply PCB** S301 (Relay Function):[2]	**NO, Normally Open**[3] NC, Normally Close
Analyzer Type:	pH, Glass	S301 (Relay Function):[2]	**NO, Normally Open**[3] NC, Normally Close
Temperature Sensor Type:	3k, Balco	S301 (Relay Function):[2]	**NO, Normally Open**[3] NC, Normally Close
Temperature Compensation Type:	Manual		
Analog Output One Range:	0 to 14 pH	**Microprocessor/Display PCB** W1 (Configuration Lockout):[3]	**1-2, Disable Lockout**[4] 2-3, Enable Lockout
Analog Output Two Range:	0 to 140°C		
Relay Output One High Setpoint Value: Deadband: Delay:	14.00 pH 0.10 pH 0.0 mins		
Relay Output Two High Setpoint Value: Deadband: Delay:	14.00 pH 0.10 pH 0.0 mins		
Relay Output Three Diagnostics:	Instrument		
Damping Value:	0.5 Seconds		
Sensor Diagnostics State:	Off (Disabled)	[1] Feature available only in Advanced programming. [2] See Figure 3-6 for switch locations. [3] See Figure 8-16 for jumper location. [4] Bold text indicates default hardware settings.	
Safety Mode One Failed Output State:	Low		
Safety Mode Two Failed Output State:	Low		
Spike Output[1] Level:	0%		

List of Effective Pages

Total number of pages in this manual is 190, consisting of the following:

Page No.	Change Date

Table of Contents

SECTION 1 - INTRODUCTION 1-1
OVERVIEW 1-1
INTENDED USER 1-2
FEATURES 1-2
EQUIPMENT APPLICATION 1-4
INSTRUCTION CONTENT 1-4
HOW TO USE THIS MANUAL 1-6
GLOSSARY OF TERMS AND ABBREVIATIONS 1-6
REFERENCE DOCUMENTS 1-9
NOMENCLATURE 1-9
SPECIFICATIONS 1-10
ACCESSORIES 1-12

SECTION 2 - ANALYZER FUNCTIONALITY AND OPERATOR INTERFACE CONTROLS 2-1
INTRODUCTION 2-1
ANALYZER OVERVIEW 2-1
USER INTERFACE 2-2
MODULAR ELECTRONIC ASSEMBLIES 2-2
TEMPERATURE COMPENSATION 2-3
ANALOG OUTPUTS 2-3
RELAY OUTPUTS 2-3
High or Low Set Point 2-4
High or Low Cycle Timer 2-4
Cleaner 2-5
DAMPING 2-6
DIAGNOSTICS 2-6
Analyzer 2-7
Sensor 2-7
Spike Output 2-7

SECTION 3 - INSTALLATION 3-1
INTRODUCTION 3-1
SPECIAL HANDLING 3-1
UNPACKING AND INSPECTION 3-2
LOCATION CONSIDERATIONS 3-3
HAZARDOUS LOCATIONS 3-3
RADIO FREQUENCY INTERFERENCE 3-3
MOUNTING 3-4
Pipe Mounting 3-4
Hinge Mounting 3-5
Wall Mounting 3-6
Panel Mounting 3-7
WIRING CONNECTIONS AND CABLING 3-9
Power Wiring 3-10
Analog Output Signal Wiring 3-11
Relay Output Signal Wiring 3-11

Advantage Series (TBX5) Sensor Wiring 3-13
Non-Advantage Series (TB5) Sensor Wiring 3-14
GROUNDING 3-17
OTHER EQUIPMENT INTERFACE 3-17
INSTRUMENT ROTATION 3-18

SECTION 4 - OPERATING PROCEDURES 4-1
INTRODUCTION 4-1

OPERATOR INTERFACE CONTROLS REVIEW 4-2
Liquid Crystal Display (LCD) 4-2
Multi-Function Smart Keys 4-3
MODES OF OPERATION 4-5
HOLD ICON 4-6
FAULT ICON 4-7
SPIKE ICON 4-7
RELAY ICONS 4-7

SECTION 5 - MEASURE MODE 5-1
INTRODUCTION 5-1
BOREDOM SWITCH 5-1
PRIMARY DISPLAY 5-1
SECONDARY DISPLAY 5-2
FAULT INFORMATION Smart Key 5-2
SPT Smart Key 5-2
MENU Smart Key 5-3

SECTION 6 - CALIBRATE MODE 6-1
INTRODUCTION 6-1
CALIBRATE STATES OF OPERATION 6-1
Process Sensor Calibrate State 6-3
One-Point Calibrate State 6-4
Two-Point Calibrate State 6-5
Temperature Calibrate State 6-8
Edit Calibrate State 6-10
Reset Calibrate State 6-12
Analog Output One Calibrate State 6-12
Analog Output Two Calibrate State 6-13

SECTION 7 - OUTPUT/HOLD MODE 7-1
INTRODUCTION 7-1
OUTPUT/HOLD STATES OF OPERATION 7-1
Hold/Release Hold Output State 7-2
Analog Output One Rerange State 7-6
Analog Output Two Rerange State 7-7
Damping State 7-8
Spike State 7-10

SECTION 8 - CONFIGURE MODE 8-1
INTRODUCTION 8-1
PRECONFIGURATION DATA REQUIRED 8-1

CONFIGURE VIEW/MODIFY STATE 8-1
BASIC/ADVANCED PROGRAMMING MODE 8-3
MODIFY CONFIGURE STATES OF OPERATION 8-4
Analyzer State (Basic/Advanced) 8-7
pH Analyzer State (Basic/Advanced) 8-8
ORP and pION States (Basic/Advanced) 8-9
Ion Concentration State (Advanced) 8-10
Temperature Sensor State (Basic/Advanced) 8-12
Temperature Compensation State (Basic/Advanced) 8-12
Manual Nernstian State (Basic/Advanced) 8-13
Automatic Nernstian State (Basic/Advanced) 8-14
Automatic Nernstian With Solution Coefficient State (Advanced) 8-15
Analog Output One State (Basic/Advanced) 8-16
Linear Output State (Basic/Advanced) 8-16

Non-Linear Output State (Advanced) 8-18
Analog Output Two State (Basic/Advanced) 8-21
Relay Output One (Basic/Advanced) 8-22
Relay Output Two (Basic/Advanced) 8-24
Relay Output Three (Basic/Advanced) 8-25
Setpoint Relay Output (Basic/Advanced) 8-27
Diagnostic Relay Output (Basic/Advanced) 8-28
Cycle Timer Relay Output (Advanced) 8-29
Cleaner Relay Output (Advanced) 8-31
Damping State (Basic/Advanced) 8-33
Diagnostics State (Basic/Advanced) 8-35
Safe Mode One State (Basic/Advanced) 8-35
Safe Mode Two State (Basic/Advanced) 8-36
Spike State (Advanced) 8-36
CONFIGURATION LOCKOUT 8-37

SECTION 9 - SECURITY MODE 9-1
INTRODUCTION 9-1
SECURITY STATE OF OPERATION 9-1

SECTION 10 - SECONDARY DISPLAY MODE 10-1
INTRODUCTION 10-1
SECONDARY DISPLAY STATE OF OPERATION 10-1

SECTION 11 - SETPOINT/TUNE MODE 11-1
INTRODUCTION 11-1
SETPOINT/TUNE STATES OF OPERATION 11-1
Setpoint Relay Output (Basic/Advanced) 11-1
Diagnostic Relay Output (Basic/Advanced) 11-3
Cycle Timer Relay Output (Advanced) 11-4
Cleaner Relay Output (Advanced) 11-6

SECTION 12 - UTILITY MODE 12-1
INTRODUCTION 12-1
FACTORY/USER STATE 12-1

User State 12-1
Advanced/Basic Programming Mode User State 12-2
Reset Configuration User State 12-3
Reset Security User State 12-4
Reset All User State 12-5
Soft Boot User State 12-6

SECTION 13 - DIAGNOSTICS 13-1
INTRODUCTION 13-1
FAULT CODES 13-1
Problem Codes 13-2
Error Codes 13-4
Calibration Diagnostic Messages 13-5
Additional Diagnostic Messages 13-6

SECTION 14 - TROUBLESHOOTING 14-1
INTRODUCTION 14-1
ANALYZER TROUBLESHOOTING 14-1
SENSOR TROUBLESHOOTING 14-5
Visual Sensor Inspection 14-6
Sensor Electronic Test 14-7

SECTION 15 - MAINTENANCE 15-1

INTRODUCTION 15-1
PREVENTIVE MAINTENANCE 15-1
Cleaning the Sensor 15-2

SECTION 16 - REPLACEMENT PROCEDURES 16-1
INTRODUCTION 16-1
ELECTRONIC ASSEMBLY REMOVAL/REPLACEMENT 16-1
FRONT BEZEL ASSEMBLY REMOVAL/REPLACEMENT 16-2
SHELL ASSEMBLY REMOVAL/REPLACEMENT 16-2
REAR COVER ASSEMBLY REMOVAL/REPLACEMENT 16-3

SECTION 17 - SUPPORT SERVICES 17-1
INTRODUCTION 17-1
RETURN MATERIALS PROCEDURES 17-1
REPLACEMENT PARTS 17-1
RECOMMENDED SPARE PARTS KITS 17-2

APPENDIX A - TEMPERATURE COMPENSATION A-1
GENERAL A-1
NERNSTIAN TEMPERATURE COMPENSATION A-1
SOLUTION COEFFICIENT A-2

APPENDIX B - PROGRAMMING TEXT STRING GLOSSARY B-1
GENERAL B-1
GLOSSARY OF PROGRAMMING TEXT PROMPTS B-1

APPENDIX C - CONFIGURATION WORKSHEETS C-1

Safety Summary

GENERAL WARNINGS

Equipment Environment
All components, whether in transportation, operation or storage, must be in a noncorrosive environment.

Electrical Shock Hazard During Maintenance
Disconnect power or take precautions to insure that contact with energized parts is avoided when servicing.

SPECIFIC CAUTIONS

To prevent possible signal degradation, separate metal conduit runs are recommended for the sensor, signal and power wiring.

Automatic Nernstian With Solution Coefficient compensation can only be used for processes that are extremely repeatable.

SPECIFIC WARNINGS

Use this equipment only in those classes of hazardous locations listed on the nameplate. Uses in other hazardous locations can lead to unsafe conditions that can injure personnel and damage equipment.

Allow only qualified personnel (refer to INTENDED USER in SECTION 1 - INTRODUCTION) to commission, operate, service or repair this equipment. Failure to follow the procedures described in this instruction or the instructions provided with related equipment can result in an unsafe condition that can injure personnel and damage equipment.

Consider the material compatibility between cleaning fluids and process liquids. Incompatible fluids can react with each other causing injury to personnel and equipment damage.

Use solvents only in well ventilated areas. Avoid prolonged or repeated breathing of vapors or contact with skin. Solvents can cause nausea, dizziness, and skin irritation. In some cases, overexposure to solvents has caused nerve and brain damage. Solvents are flammable - do not use near extreme heat or open flame.

Do not substitute components that compromise the certifications listed on the nameplate. Invalidating the certifications can lead to unsafe conditions that can injure personnel and damage equipment.

Do not disconnect equipment unless power has been switched off at the source or the area is known to be nonhazardous. Disconnecting equipment in a hazardous location with source power on can produce an ignition-capable arc that can injure personnel and damage equipment.

Remove power from the unit and allow at least one minute for the unit to discharge before performing these procedures. Failure to do so constitutes an electrical shock hazard that can injure personnel and damage equipment.

Disconnect the AC line cord or power lines from the operating branch circuit coming from the source before attempting electrical connections. Instruments powered by AC line voltage constitute a potential for personnel injury due to electric shock.

Keep the enclosure and covers in place after completing the wiring procedures and during normal operation. Do not disconnect or connect wiring or remove or insert printed circuit boards unless power has been removed and the flammable atmosphere is known NOT to be present. These procedures are not considered normal operation. The enclosure prevents operator access to energized components and to those that can cause ignition capable arcs. Failure to follow this warning can lead to unsafe conditions that can injure personnel and damage equipment.

All error conditions are considered catastrophic. When such an error has been reported, the analyzer should be replaced with a known-good analyzer. The non-functional analyzer should be returned to the factory for repair. Contact the factory for a Return Materials Authorization (RMA) number.

SECTION 1 - INTRODUCTION

OVERVIEW

The TB84PH Advantage Series is a line-powered pH/ORP/pION (i.e., specific ion) analyzer with state-of-the-art electronics, internal and external diagnostic functionality, an innovative user-interface having *HotKey* capability, two user-selectable modes of operation, and DIN-size packaging.

Diagnostic interrogation of the internal circuitry and external sensing devices is continually conducted to ensure accuracy and immediate notification of problem situations when they occur. Detection of sensor integrity includes pH electrode damage, sensor coating, sensor out-of-liquid, ground-loop detection, and short/open sensor cabling. Additional software functions monitor slope, asymmetric potential, process variable over/under range, and temperature over/under range. If these diagnostic conditions occur, the analyzer can be programmed to induce a repetitive modulation of a given magnitude in the output current or can be link to a relay output thus providing the ability to alert personnel of a problem condition.

The analyzer packaging conforms to DIN standards and has mounting options that include pipe, wall, hinge, and panel installations. Due to the modular design of the electronics, changing the analyzer sensing capability to other analytical properties such as solution conductivity can be quick and easy.

The user interface is an innovative, patent-pending technology which facilitates a smooth and problem-free link between the user and analyzer functionality. The programming structure and multi-function keys reduce programming difficulties by providing a toggle between *Basic* and *Advanced* functions.

INTENDED USER

Installation Personnel Should be an electrician or a person familiar with the National Electrical Code (NEC), or equivalent, and local wiring regulations. Should have a strong background in installation of analytical equipment.

Application Technician Should have a solid background in pH/ORP/pION measurements, electronic instrumentation, and process control and be familiar with proper grounding and safety procedures for electronic instrumentation.

Operator Should have knowledge of the process and should read and understand this instruction book before attempting any procedure pertaining to the operation of the TB84PH Advantage Series analyzer.

Maintenance Personnel Should have a background in electricity and be able to recognize shock hazards. Personnel must also be familiar with electronic process control instrumentation and have a good understanding of troubleshooting procedures.

FEATURES

Diagnostic Sensor Capability The TB84PH Advantage Series analyzer offers the necessary hardware and software for full compatibility with TBX5 Advantage Series pH/ORP/pION sensors. These sensors are equipped with the new NEXT STEP reference technology and are well suited for harsh process streams.

Multiple Applications Accepts inputs from standard glass pH electrodes, antimony pH electrodes, gold or platinum Oxidation-Reduction Potential (ORP) electrodes, or any specific ion electrode. A custom electrode configuration is also available which uses information regarding the asymmetric potential and isopotential point. Isolated analog outputs allows use in grounded or floating circuits. Relay outputs provide setpoint control, cycle-timer control, diagnostic alarming, and cleaner operation.

Automatic Temperature Compensation

Menu-selectable choices provide the user with a wide range of easily configurable selections for temperature compensation.

1. Automatic Nernstian
2. Automatic Nernstian with Solution Coefficient
3. Manual Nernstian

Wide Rangeability

Analog output spans do not affect the display range of -2.00 to +16.00 pH (-2000 to +2000 mV for ORP and specific ion). Minimum and maximum process variable output spans are 1.0 pH (100 mV for ORP and specific ion) and 14 pH (3998 mV for ORP and specific ion), respectively. Minimum and maximum temperature output spans are 10 ^{o}C (18 ^{o}F) and 140 ^{o}C (284 ^{o}F), respectively.

Innovative User Interface

Using four Smart Keys and a custom Liquid Crystal Display (LCD), multiple functions have been assigned to each key and are displayed at the appropriate time depending on the programming environment. This patent-pending technology reduces the number of keys while maintaining the maximum amount of functionality and allows for the use of a larger, more visible LCD.

Simple Calibration

One- and two-point calibrations are available and smoothly guide the user through each calibration step. Provisions for viewing and modifying the sensor calibration data are also included. Temperature calibration uses smart calibration routines which determine the appropriate adjustments based on previous calibration data.

NEMA 4X/IP65 Housing

Suitable for corrosive environments, the electronics enclosure is a corrosion resistant, aluminum alloy. A chemical resistant polyurethane powder coating provides external protection.

Suitable for Hazardous Locations

The TB84PH Advantage Series analyzer design complies with industry standards for Division 2 and non-incendive installations (certification pending).

Diagnostic Indication

The custom LCD has dedicated icons which act as visible indications of an output hold, fault, diagnostic spike, and energized relay condition.

Secure Operation A hardware lockout feature prevents unauthorized altering of instrument configuration parameters while allowing other analyzer functions to be fully accessible. Software security codes can also be assigned to the Configure, Calibrate, Output/Hold, and Setpoint/Tune Modes of Operation.

Compact Packaging Industry standard ½-DIN size maintains standard panel cut outs and increases installation flexibility by providing pipe, wall, hinge, and panel mounting options.

Nonvolatile Memory In the event of a power failure, the nonvolatile memory stores and retains the configuration and calibration data.

Analyzer Diagnostics Built-in electronic circuitry and firmware routines perform a series of self-diagnostics, monitoring such areas as memory and input circuit integrity. Irregularities are indicated for maintenance purposes.

EQUIPMENT APPLICATION

The TB84PH Advantage Series analyzer can be used anywhere pH, ORP, or specific ion measurements are desired.

INSTRUCTION CONTENT

Introduction This section provides a product overview, a description of each section contained in this manual, and how each section should be used. This section also has a glossary of terms and abbreviations, a list of reference documents on related equipment and/or subjects, the product identification (nomenclature), and a comprehensive list of hardware performance specifications including accessories and applicable certification information.

Analyzer Functionality And Operator Interface Controls This section provides a short description on the functionality of the TB84PH Advantage Series analyzer.

Installation This section provides information on analyzer installation such as unpacking directions, location considerations, analyzer mounting options and procedures, wiring instructions, sensor connections, and grounding procedures.

Operating Procedures This section addresses the operator interface controls and their function. The Mode of Operation and LCD status icons are listed and their functions are described.

Measure Mode This section describes the normal analyzer mode of operation which includes the primary and secondary display, Fault Information Smart Key, and Menu Smart Key functions.

Calibrate Mode This section provides sensor and analyzer calibration procedures and calibration data descriptions.

Output/Hold Mode This section describes the Output/Hold States of Operation including hold, rerange, damping, and spike features.

Configure Mode This section defines the required actions to establish and program the analyzer configuration.

Security Mode This section provides the procedures necessary to set and clear analyzer security codes.

Secondary Display Mode This section provides the procedure necessary to set the information displayed in secondary display of the Measure Mode.

Utility Mode This section defines the reset options and Basic/Advanced programming toggle.

Diagnostics This section provides a description of the diagnostic tools available to aid with analyzer servicing. This section also provides a listing of displayed faults and the corrective action to be taken.

Troubleshooting This section provides an analyzer and sensor troubleshooting guide to help determine and isolate problems.

Sensor Maintenance This section provides cleaning procedures for pH/ORP/pION sensors.

Repair/Replacement This section includes procedures for analyzer assembly and sensor replacement.

Support Services This section provides a list of replacement parts unique to the TB84PH Advantage Series analyzer.

Appendix A This section provides temperature compensation information.

Appendix B This section provides a glossary of text prompts used in the secondary display during analyzer programming.

Appendix C This section provides a configuration worksheet used to record the analyzer's configuration and shows default values when a configuration reset is performed.

HOW TO USE THIS MANUAL

For safety and operating reasons, reading and understanding this product instruction manual is critical. Do not install or complete any tasks or procedures related to operation until doing so.

The sections of this product instruction are sequentially arranged as they relate to initial start-up (from UNPACKING to REPAIR/REPLACEMENT PROCEDURES). After initial start-up, refer to this instruction as needed by section.

GLOSSARY OF TERMS AND ABBREVIATIONS

Table 1-1. Glossary of Terms and Abbreviations

Term	Description
Asymmetric Potential	The electrical potential across the measuring and reference half-cells of an electrochemical sensor at the Isopotential Point.
Boredom Switch	An automatic timer built into the TB84PH Advantage Series analyzer that returns the instrument to the Measure Mode of Operation if a user has entered another mode of operation and has not initiated another action for twenty minutes.
EEPROM	Electrically Erasable Programmable Read Only Memory. A type of non-volatile memory that can be electrically programmed and erased.
Efficiency	A value that represents the percentage of the theoretical, Nernstian temperature compensated output from an electrochemical sensor.
EPROM	Erasable Programmable Read Only Memory. This memory holds the operational program for the microcontroller integral to the analyzer.
Ground Loop	A path between two separate ground connections thus allowing unwanted current flow through the measurement cabling or circuitry.

Term	Description
HotKey	A short-cut that moves the user from the View Configure State to the Modify Configure State of Operation.
Icon	A text or symbolic image representing a set function, condition, or engineering unit.
Impedance	A measure of the total opposition to current flow in an alternating-current circuit.
Isopotential Point	The potential of an electrochemical sensor that is independent to sample fluid temperature changes.
LCD	Liquid Crystal Display. The custom three and one-half digit primary display, six-character alpha-numeric secondary field, and supporting icons that allow for local readout of the process variable, programming of analyzer functions, and local indication of fault, hold, and relay state conditions.
Non-volatile Memory	Memory that retains programmed information such as configuration and calibration parameters, even when power is removed.
ORP	Oxidation-Reduction Potential. The potential created during a chemical reaction in which one or more electrons are transferred from one atom or molecule to another.
PCB	Printed Circuit Board. A flat board which contains pads for integrated circuit chips, components, connections, and electrically conductive pathways between those elements that function together to form an electronic circuit.
pH	Potential of Hydrogen. A measure of the acidity or alkalinity of a solution, numerically equal to 7 for neutral solutions, increasing with increasing alkalinity and decreasing with increasing acidity.
RTD	Resistive Temperature Detector. An element whose resistance has a relationship with the temperature of its surroundings.
SEEPROM	Serial Electrically Erasable Programmable Read Only Memory. A type of non-volatile memory that can be electrically programmed, erased, and read using serial communication techniques.

Term	Description
Slope	The linear relation between two sets of variables that describes the rate of change between these variables.
Specific Ion (pION)	Potential of a Specific Ion. A potential produced by an Ion Specific Electrode that varies logarithmically with the ion's concentration.
Solution Coefficient	A method of temperature compensation that compensates for a constant change in ion dissociation relative to temperature. The units are in 0.000 pH per °C for pH and 0.00 mV per °C for ORP, pION, and Ion Concentration.
Valence	An integer used to represent the capacity of an atom or group of atoms to combine in specific proportions with other atoms or groups of atoms.

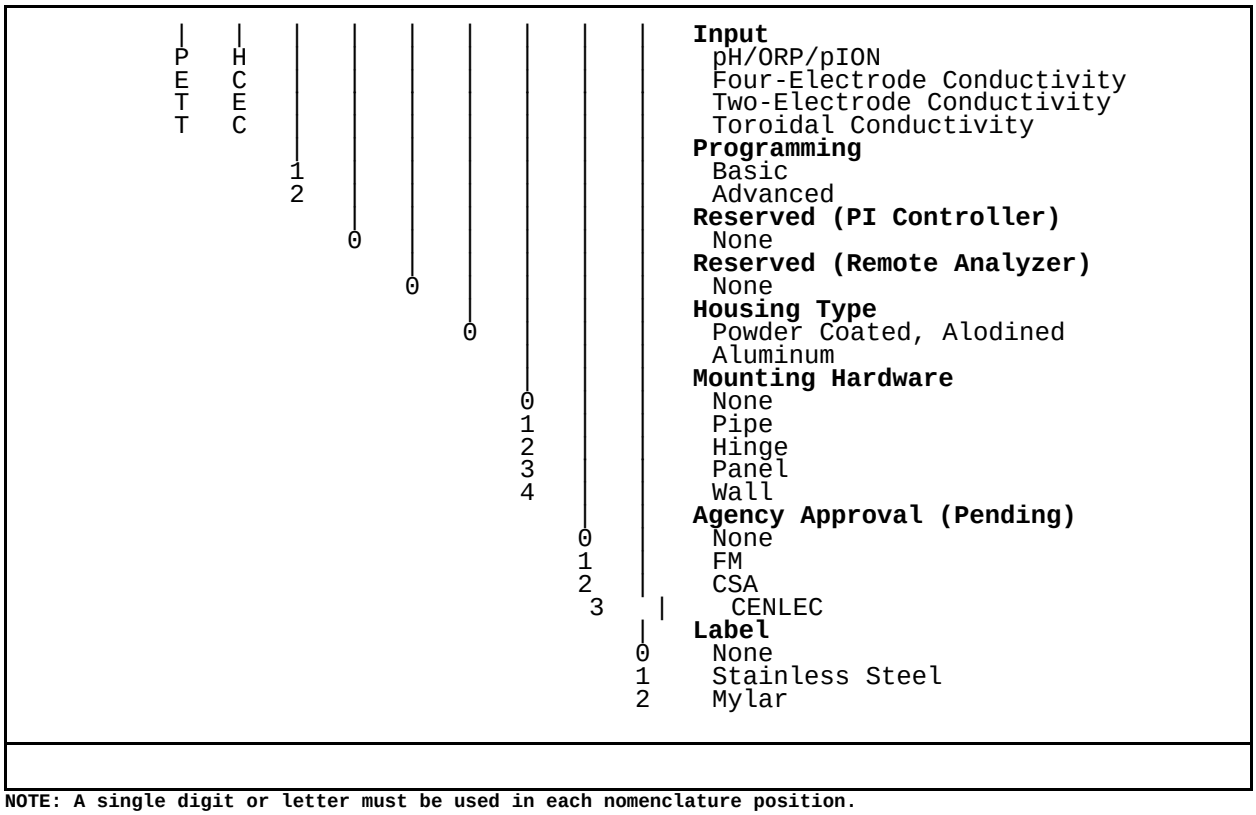
REFERENCE DOCUMENTS

Table 1-2. Reference Documents

Number	Document
E67-21-3	pH/ORP Sensors for Process Monitoring
WTPEEUS520003A0	TB84PH Advantage Series Product Specification
TP93-11	Validation of Field pH Sensors
TP90-2	Calibration and Troubleshooting of pH Loops
TP96-1	Temperature Another Wild Card in pH Control

NOMENCLATURE

Position	5	6	7	8	9	10	11	12	13	
Type TB84	☐	☐	☐	☐	☐	☐	☐	☐	☐	Advantage Series Analyzer



NOTE: A single digit or letter must be used in each nomenclature position.

SPECIFICATIONS

Table 1-3. Specifications

Property	Characteristic/Value
Process Display Range pH ORP pION	 -2 to +16.00 pH -1999 to +1999 mV -1999 to +1999 mV
Temperature Display Range	0° to 140°C (32° to 284°F).
Resolution, Display pH ORP pION Temperature	 0.01 pH 1 mV 1 mV 1°C, 1°F.
Accuracy, Display pH ORP pION Temperature Accuracy, Output	 ±0.01 pH ±1 mV ±1 mV 1°C ±0.02 mA at full scale output setting
Nonlinearity, Display pH ORP pION Temperature Nonlinearity, Output	 ±0.01 pH ±1 mV ±1 mV 1°C ±0.02 mA at full scale output setting
Repeatability, Display pH ORP pION Temperature Repeatability, Output	 ±0.01 pH ±1 mV ±1 mV 1°C ±0.02 mV at full scale output setting
Stability, Display pH ORP pION Temperature Stability, Output	 ±0.01 pH ±1 mV ±1 mV 1°C ±0.02 mV at full scale output setting
Temperature Compensation	Manual Nernstian Automatic Nernstian Automatic Nernstian with Solution Coefficient
Input Types pH ORP pION Temperature	 Glass, Antimony, Custom Isopotential & Asymmetric Potential Platinum, Gold Sodium, Chloride, Sulfide, etc. 3 kohm Balco, Pt100
Dynamic Response	3 sec. for 90% step change at 0.0 sec. damping.
Ambient Temperature Effect pH ORP pION Temperature Output	 ±0.007 pH/°C @ 95% Relative Humidity ±0.4 mV/°C @ 95% Relative Humidity ±0.4 mV/°C @ 95% Relative Humidity ±0.16 °C/°C @ 95% Relative Humidity ±0.008 mA/°C @ 95% Relative Humidity

Property	Characteristic/Value
Output Minimum Span pH ORP pION Temperature	 1.00 pH 100 mV 100 mV 10 °C
Output Maximum Span (full scale settings) pH ORP pION Temperature	 14 pH (0 to 14 pH) 3998 mV (-1999 to 1999 mV) 3998 mV (-1999 to 1999 mV) 140 °C, 284 °F (0 to 140 °C, 32 to 284 °F)
Damping	Continuously adjustable from 0.0 to 99.9 seconds
Supply Voltage Ranges	93.5 to 276 Vac, 50 to 60 Hz, Single Phase Maximum Consumption 17 VA
Analog Output Ratings	Two completely isolated 0/4 to 20 mAdc outputs 750 ohms Maximum Load Value Output One Fixed to the Process Variable Output Two Software-Selectable to either the Process Variable or Temperature
Relay Output Ratings	Three SPDT contacts with LCD icon indicators Hardware configurable for Normally Open or Normally Close Software configurable relay functions include High/Low Setpoint with adjustable Deadband and Time Delay, High/Low Cycle Timer with adjustable Duty Cycle and Time Delay, Diagnostic Alarm, and Cleaner Control Maximum AC Capacity Values of 100 VA, 240 Vac, and 3 A Maximum DC Capacity Values of 50 W, 24 Vdc, and 3 A
Power Supply Effect	±0.005% of full scale span per volt
Turn-On Time	2 seconds typical, 4 seconds maximum
Maximum Sensor Cable Length	100 ft (30.5 m)
Sensor Diagnostic pH ORP pION	 Glass and Reference Impedance, Open and Short Cabling, Efficiency and Asymmetric Potential Check Reference Impedance, Open and Short Cabling, Efficiency and Asymmetric Potential Check Reference Impedance, Open and Short Cabling, Efficiency and Asymmetric Potential Check
Diagnostic Notification Analog Mode	Local indication via a FAULT and SPIKE icon. Programmable output pulse on Analog Output One, 0 to 16 mA for 1 seconds on 6 second cycles
Environmental Operating temperature LCD Range Storage temperature	 -20° to 60°C (-4° to 140°F) -20° to 60°C (-4° to 140°F) -40° to 70°C (-40° to 158°F)
Mounting Effect	None
Enclosure Classification	NEMA 4X IP65
Size Height Minimum panel depth Maximum panel cutout	 144 mm high x 144 mm wide x 171 mm long (5.67 in. high x 5.67 in. wide x 6.75 in. long) 145 mm (5.70 in.) 136.7 mm x 136.7 mm (5.38 in. x 5.38 in.).

Property	Characteristic/Value
Weight	4.2 lb (1.9 kg) without mounting hardware 7.5 lb (3.4 kg) with Pipe Mounting Hardware
EMC Requirements	CE certified: Electromagnetic Emission - EN50082-1: 1994 EN55011: 1991 (CISPR11: 1990) Class A Electromagnetic Immunity - EN50082-2: 1996 EN61000-4-2: 1995 6 kV Contact 6 kV Indirect EN61000-4-3: 1997 10 V/m (unmodulated, rms) 80 to 1000 MHZ EN61000-4-4: 1995 1 kV Signal Lines 5/50 T_r/T_h nS 5 kHz EN61000-4-8: 1994 50 Hz 30A(rms)/m ENV50141: 1994 10 V (unmodulated, rms) 0.15 to 80 MHZ 80% AM (1kHz) 150 ohms, source impedance ENV50204: 1996 10 V/m (unmodulated, rms) 900 ±5 MHZ 50% duty cycle 200 Hz Low Voltage - EN61010-1:1993 (Category II)
Agency Approvals[1] (pending) FM CSA	 Non-incendive. Class I, Division 2, Groups A, B, C, and D. Class II, Division 2, Groups F and G. Class III, Division 2. Class I, Division 2, Groups A, B, C, and D. Class II, Division 2, Groups E, F and G. Class III, Division 2.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

1. Hazardous location approvals for use in flammable atmospheres are for ambient conditions of -25° to 40°C (-13° to 104°F), 86 to 108kPa (12.5 to 15.7 psi) with a maximum oxygen concentration of 21%.

ACCESSORIES

Kits

Part Number	Mounting Kit
4TB9515-0124	Pipe
4TB9515-0125	Hinge
4TB9515-0156	Wall
4TB9515-0123	Panel

Part Number	Description
4TB9515-0164	BNC Adapter
4TB9515-0166	BNC Adapter w/ ½" Cord Grip Fitting
4TB9515-0165	½" Cord Grip Fitting
4TB9515-0191	PG9 Cord Grip Fitting
4TB9515-0198	Complete Cord Grip Set (Three PG9 p/n 4TB9515-0191 & Two ½" p/n 4TB9515-0165)

See Section 17, Support Services, for a complete list of available kits.

Sensors

Nomenclature[1]	Fitting Type
TBX551, TB551	In-line Twist Lock, Submersible
TBX556, TB556	In-line Threaded, Submersible
TBX557, TB557	Ball Valve Insertion, Hot Tap
TBX561, TB561	Sterilizable, In-line
TBX564, TB564	High Pressure Hot Tap
TBX567, TB567	High Pressure In-line

[1] TBX5 Advantage Series Sensors required for advanced sensor diagnostics. BNC Adapter Kit required for TB5 Sensors with BNC Connector. When using TB5 Sensors with type T (i.e., Pin Lug) terminations, the BNC Adapter p/n 4TB9515-0164 is not required. See Section 3, Installation, for more information.

SECTION 2 - ANALYZER FUNCTIONALITY AND OPERATOR INTERFACE CONTROLS

INTRODUCTION

The beginning of this section contains an overview of the TB84PH pH/ORP/pION Advantage Series analyzer functionality and important information for configuration personnel. The latter part of this section discusses the operator interface controls. It includes descriptions of the analyzer modes and faceplate controls.

ANALYZER OVERVIEW

The TB84PH Advantage Series analyzer provides two analog output signals that can be configured to be proportional to either the output of any electrochemical sensor having a DC voltage output between -2000 and +2000 mV and/or a 3k Balco or Pt100 RTD. This includes sensors requiring electrometer type detectors such as pH, ORP, and specific ion (i.e., pION) sensors. In addition to the two analog outputs, any of the three integral relay outputs can be configured as a high or low setpoint controller, cycle-timer controller, diagnostic alarm, or cleaner controller. In this manner, the TB84PH Advantage Series analyzer provides a means by which to monitor and control the pH, ORP, pION, or Ion Concentration of a process fluid.

This analyzer is equipped with internal diagnostic capabilities allowing for the detection of any potential problems with the electronics and operation of firmware. Diagnostic capability also includes the detection of sensor integrity such as pH glass electrode impedance, reference electrode impedance, ground-loop detection, open and shorted cabling, process variables out of range, and incorrect calibration values.

USER INTERFACE

The user interface consists of a tactile keypad having four Smart keys, one hidden key, and a custom LCD. The LCD has a three and one-half digit numeric region that displays the process variable, a six-digit alphanumeric region that displays secondary information and programming prompts, and several status-indicating and programming icons.

Using a novel approach (patent-pending), each of the four keys is located under a given set of icons. In each of the instrument modes and mode states, one icon over any given key will be illuminated and will represent that key's function. These Smart Key assignments will vary as the user enters into different programming modes and states. In addition to the Smart Key assignments, text strings located in the six character alphanumeric field (i.e., secondary display) are used as programming prompts. The end result is an interface that provides a great deal of flexibility and functionality.

MODULAR ELECTRONIC ASSEMBLIES

The TB84PH Advantage Series analyzer consists of three separate PCB assemblies that concentrate specific circuit functionality onto each of the three boards. This modular design allows for the ability to change the instrument from one of four types of instruments: pH/ORP/pION, four-electrode conductivity, two-electrode conductivity, and toroidal conductivity. In addition, analyzer repairs can be quickly accomplished by simply replacing the non-functioning board with an operational one.

TEMPERATURE COMPENSATION

The process temperature can be monitored using one of two types of RTD inputs: 3 kohm Balco and Pt100 (US385). The secondary display area can also be set to display the temperature in degrees Celsius or Fahrenheit when the TB84PH Advantage Series is in the Measure mode of operation.

Since temperature influences the output of electrochemical electrodes as well as the physical properties of the process fluid, several temperature compensation functions are available. Temperature compensation options for pH include Manual Nernstian, Automatic Nernstian, and Automatic Nernstian with Solution Coefficient. Options for ORP and pION include Manual (i.e., No Compensation) and Solution Coefficient.

ANALOG OUTPUTS

The TB84PH Advantage Series analyzer has two analog outputs. These outputs can be either direct or reverse acting and can be software-configured for a range of zero to 20 milliamps or four to 20 milliamps. Both outputs are separately scalable, isolated from the input, and isolated from one another.

The analog outputs provide process information to recorders, data loggers, and control systems. The information transmitted can represent (i.e., be sourced to) process pH, ORP, pION, Ion Concentration, or temperature and be ranged across any portion of the particular measurement range. See Table 1-3, Specification, for minimum and maximum range values.

RELAY OUTPUTS

The TB84PH Advantage Series analyzer has three Form C, SPDT relay outputs. The relays can be independently programmed to perform various functions as required by the application.

These functions include:

- Process control (Setpoint or Cycle Timer).
- Diagnostic condition notification.
- Cleaner control.

High or Low Set Point

High or low set point relays are configurable for any value within the measurement range. Each set point relay output allows for separate programmability of relay function (high or low), set point value, deadband value, and delay.

The example shown in Figure 2-1 illustrates a high set point relay output of 10.00 pH with a deadband of 0.10 pH. The relay activates at 10.00 pH and deactivates when the process pH drops below 9.90 pH. The second half of the figure shows the same situation with a 1.0 minute delay before the high set point relay activates. Set point functions are programmable as high or low acting. Setpoint, deadband, and delay value are all tunable parameters available in the Setpoint/Tune Mode of Operation.

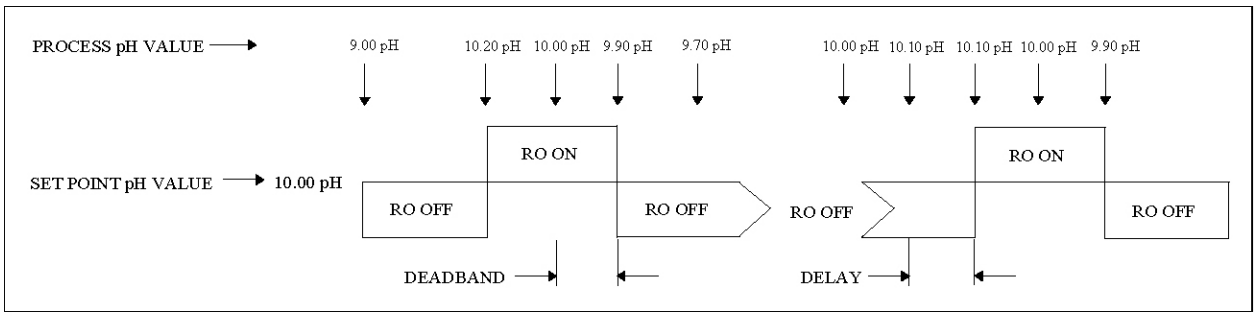


Figure 2-1. High Set Point and Time Delay Example.

High or Low Cycle Timer

High or low cycle timer relays are configurable for any value within the measurement range. A cycle timer relay output allows for separate programmability of relay function (high or low), set point value, cycle time, and on time.

The example shown in Figure 2-2 illustrates a cycle timer that will be active when the process variable exceeds the high set point value of 10.00 pH. Once active, the relay output energizes for the configured on time. As long as the process continues to exceed the set point value, the timer will reset itself at the end of the duty cycle (i.e., cycle time). The set point, cycle time, and on time are all tunable parameters available in the Setpoint/Tune Mode of Operation.

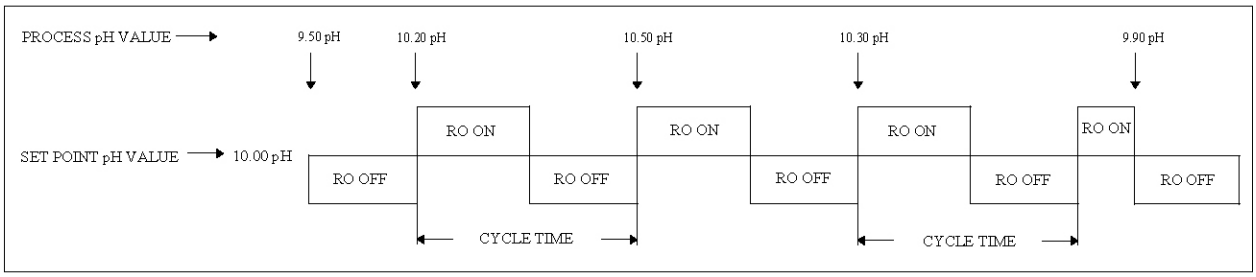


Figure 2.2. Cycle Timer High Set Point Example.

Cleaner

Automatic sensor cleaning can be accomplished using one of the three relay outputs. At a prescribed time interval (i.e., cycle time), a cleaner relay output will energize and thus enable a cleaning device. The cleaner relay will remain energized for a configured cleaning period (i.e., on time). Since many cleaning devices use cleaning solutions that can affect the process measurement, the analog and non-cleaner relay outputs can be held during the cleaning period. If needed, non-cleaner relay outputs can be completely disabled (i.e., de-energized) instead of held. Thus, an operator does not need to be concerned with the possibility of a non-cleaner relay being held in an incorrect state for an undesirable length of time.

In addition to a cleaning period, a recovery period can be programmed to extent any configured hold and/or disabling conditions beyond the clean period. This feature allows cleaning fluids to dissipate or sensor conditions to stabilize before returning to the normal mode of operation.

The set point, cycle time, and on time are all tunable parameters available in the Setpoint/Tune Mode of Operation.

DAMPING

Damping can be adjusted from 0 to 99.9 seconds. This feature is useful in noisy process environments to help stabilize the displayed process variable and output current from excess bounce. Damping can be applied to the displayed and/or analog output values.

Damping simulates a capacitive type lag where reaction to any signal change is slowed according to an entered time constant. For example, a step change will reach approximately 63 percent of its final value in five seconds for five seconds of damping.

DIAGNOSTICS

Diagnostics are provided for both the analyzer and sensor. Diagnostics detection of a serious condition that prevents the instrument from properly functioning enables preset Safe Mode states. These Safe Mode states are configured by the user and forces the outputs to either high and/or low.

For problems that occur that do not render the instrument in a non-functioning state, the user has the option of linking these conditions to a Diagnostic Spike that is superimposed onto Analog Output One and/or to a one or more relay outputs.

If the Diagnostic Spike is enabled, Analog Output One will modulate for one out of every six seconds. The magnitude of the modulation can be set from 0 to 100% of the analyzer's maximum output (i.e., 0 to 16 or 20 mA).

Detection of over forty problem conditions can be enabled by the user if so desired. Diagnostic conditions cause the FAULT and FAULT INFO icons on the display to be energized. Interrogation of each fault condition is available with a single keystroke.

Analyzer

Five critical errors in operation are monitored and linked to the Safe Mode feature. These conditions include inoperable or incorrect input circuit, bad RAM, and damaged EE memory.

Sensor

The analyzer continually performs diagnostic checks on sensor integrity. Inconsistencies

in sensor performance are notified by the FAULT and FAULT INFO icons as well as the Spike Output and/or Diagnostic Relay(s) if configured.

Sensor faults include low measuring electrode impedance (glass pH only), high reference impedance, shorted cable, open cable/sensor out of solution, shorted/open temperature sensor, high and low PV, high and low temperature, and many more. See Section 13, Diagnostics, for more details.

Spike Output

Remote problem condition notification can be initiated by the TB84PH Advantage Series analyzer using the SPIKE State in the Configure Mode. The Spike Output option allows users to program a 0 to 100% (i.e., 0 to 16 mA for 4 to 20 mA configurations or 0 to 20 mA for 0 to 20 mA configurations) pulse that will be impressed on Analog Output One for one second out of a six second repeating cycle should a problem condition be detected. Should the actual output of the analyzer be below mid-scale, the pulse will add current; if above mid-scale, it will subtract current.

SECTION 3 - INSTALLATION

INTRODUCTION

This section of the manual will aide the user in all levels of the installation process. The intention is to provide simple procedures for placing the TB84PH Advantage Series analyzer into service.

SPECIAL HANDLING

Besides the normal precautions for storage and handling of electronic equipment, the analyzer has special static sensitive device (SSD) handling requirements. This equipment contains semiconductors subject to damage by discharge of static electricity; therefore, avoid direct contact with terminal block conductors and electronic components on the circuit board.

To minimize the chances of damage by static electricity, follow these techniques during wiring, service, troubleshooting, and repair.

1. Remove assemblies containing semiconductors from their protective containers only:

   a. When at a designated static-free work station.

   b. After firm contact with an antistatic mat and/or gripped by a grounded individual.

2. Personnel handling assemblies with semiconductors must be neutralized to a static-free work station by a grounding wrist strap connected to the station or to a good ground point at the field site.

3. Do not allow clothing to make contact with semiconductors. Most clothing generates static electricity.

4. Do not touch connectors, circuit traces, and components.

5. Avoid partial connection of semiconductors. Semiconductors can be damaged by floating leads. Always install electronic assemblies with power removed. Do not cut leads or lift circuit paths when troubleshooting.

6. Ground all test equipment.

7. Avoid static charges during maintenance. Make sure the circuit board is thoroughly clean around its leads but do not rub or clean with an insulating cloth.

NOTE: An antistatic field service kit, ABB part number 1948385_1, is available for personnel working on devices containing static sensitive components. The kit contains a static dissipative work surface (mat), a ground cord assembly, wrist bands, and alligator clip.

UNPACKING AND INSPECTION

Examine the equipment upon receipt for possible damage in transit. File a damage claim with the responsible transportation company, if necessary. Notify the nearest ABB sales office.

Carefully inspect the packing material before discarding it to make certain that all mounting equipment and any special instructions or paperwork have been removed. Careful handling and installation will insure satisfactory performance of the unit.

Use the original packing material and container for storage. Select a storage environment free of corrosive vapors and extreme temperature and humidity. Storage temperature must not exceed -40 degrees to +70 degrees Celsius (-40 degrees to +158 degrees Fahrenheit).

Remove the protective film from the analyzer lens after the analyzer has been placed in its final installed location.

LOCATION CONSIDERATIONS

When mounting the unit, leave ample clearance for removal of the front bezel and rear cover. Signal wiring should not run in conduit or open trays where power wiring or heavy electrical equipment could contact or interfere with the signal wiring. Twisted, shielded pairs should be used for the best results.

The mounting location should provide easy access for maintenance procedures and not be in a corrosive environment. Excessive mechanical vibrations and shocks as well as relay and power switches should not be in the immediate area. Additionally, this location must conform to the temperature and humidity constraints listed in the Table 1-3, Specifications.

HAZARDOUS LOCATIONS

WARNING	**Use this equipment only in those classes of hazardous locations listed on the nameplate. Installations in hazardous locations other than those listed on the nameplate can lead to unsafe conditions that can injure personnel and damage equipment.**

Refer to Table 1-3, Specifications, in Section 1 for a list of certifications and approvals applicable to the TB84PH Advantage Series analyzer.

RADIO FREQUENCY INTERFERENCE

Most electronic equipment is affected to some extent by radio frequency interference (RFI). Caution should be exercised with regard to the use of portable communications equipment in areas where this electronic equipment is being used. Post appropriate cautions in the plant as required.

MOUNTING

The TB84PH Advantage Series analyzer can be pipe, hinge, wall, or panel mounted. Figure 3-1 shows the overall dimensions of the TB84PH without mounting hardware. Mounting hardware attaches to the four sets of threaded holes located on the corners of the main housing.

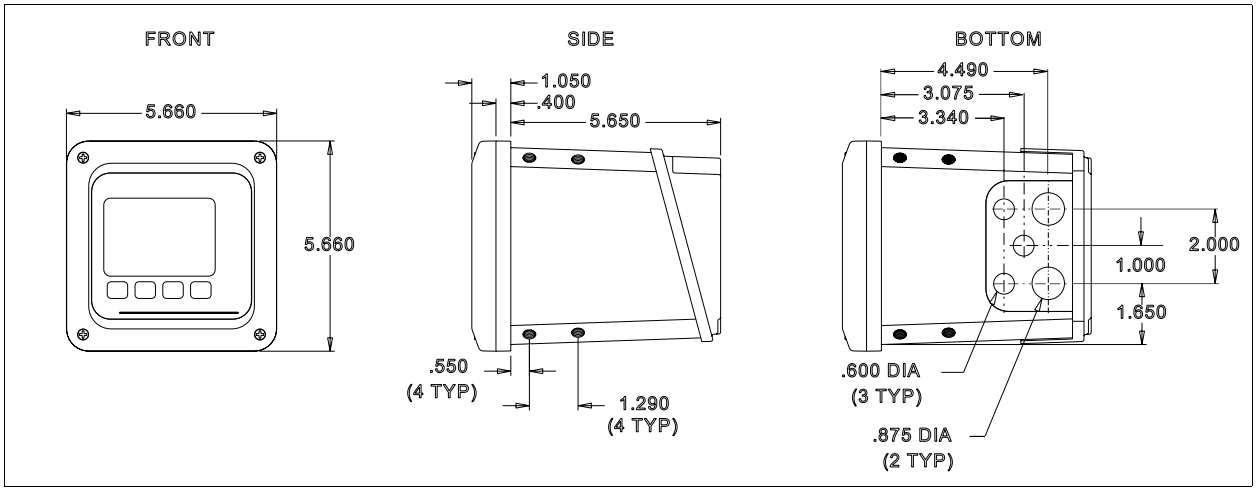


Figure 3-1. Overall Dimensions

Pipe Mounting

The TB84PH Pipe Mount Kit (p/n 4TB9515-0124) contains a pipe and instrument mounting bracket with associated hardware. The pipe mounting bracket can be fitted to pipe sizes as large as two-inches.

Using Figure 3-2 as a reference, mount the TB84PH analyzer as follows:

1) Select the desired orientation of the TB84PH analyzer.

2) Attach the instrument mounting bracket to the pipe mounting bracket using the supplied 3/8" x 3/4" bolts, 3/8" flat washers, 3/8" lock washers, and 3/8" nuts.

3) Attach the pipe mounting bracket to the pipe using the supplied 5/16" U-bolts, 5/16" flat washers, 5/16" lock washers, and 5/16" nuts.

4) Attach the instrument to the instrument mounting bracket using the supplied 3/8" x 5/8" bolts, 3/8" flat washers, and 3/8" lock washers.

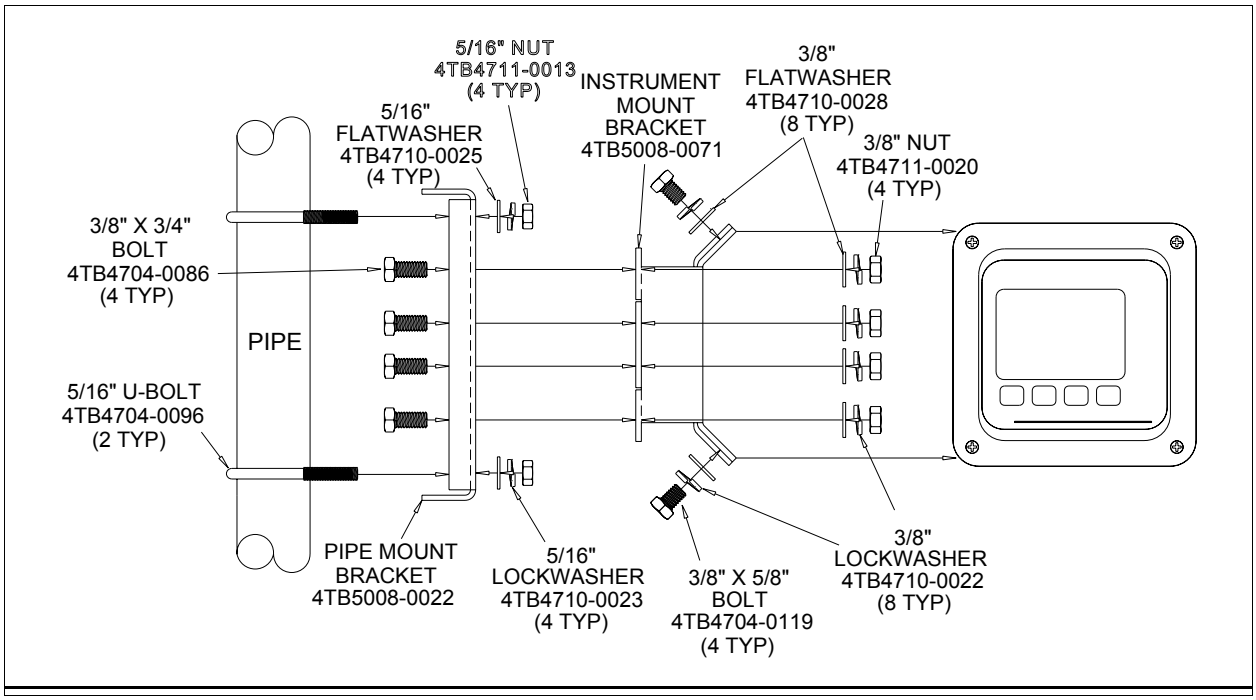


Figure 3-2. Pipe Mount Installation Diagram

Hinge Mounting

The TB84PH Hinge Mount Kit (p/n 4TB9515-0125) contains L- and instrument mounting brackets, a stainless steel hinge, and associated hardware. The Hinge Mount Kit allows for a clear view of the display while maintaining easy access to the rear of the instrument.

Using Figure 3-3 as a reference, mount the TB84PH analyzer as follows:

1) Select the desired location and orientation of the TB84PH analyzer.

2) Attach the L-bracket to the selected location using the appropriate type of fastener based on the mounting surface material.

3) Attach the stainless steel hinge to the L-bracket using the supplied 3/8" x 3/4" bolts, 3/8" flat washers, 3/8" lock washers, and 3/8" nuts.

4) Attach the instrument mounting bracket to the stainless steel hinge using the supplied 3/8" x 3/4" bolts, 3/8" flat washers, 3/8" lock washers, and 3/8" nuts.

5) Attach the instrument to the instrument

mounting bracket using the supplied 3/8" x 5/8" bolts, 3/8" flat washers, and 3/8" lock washers.

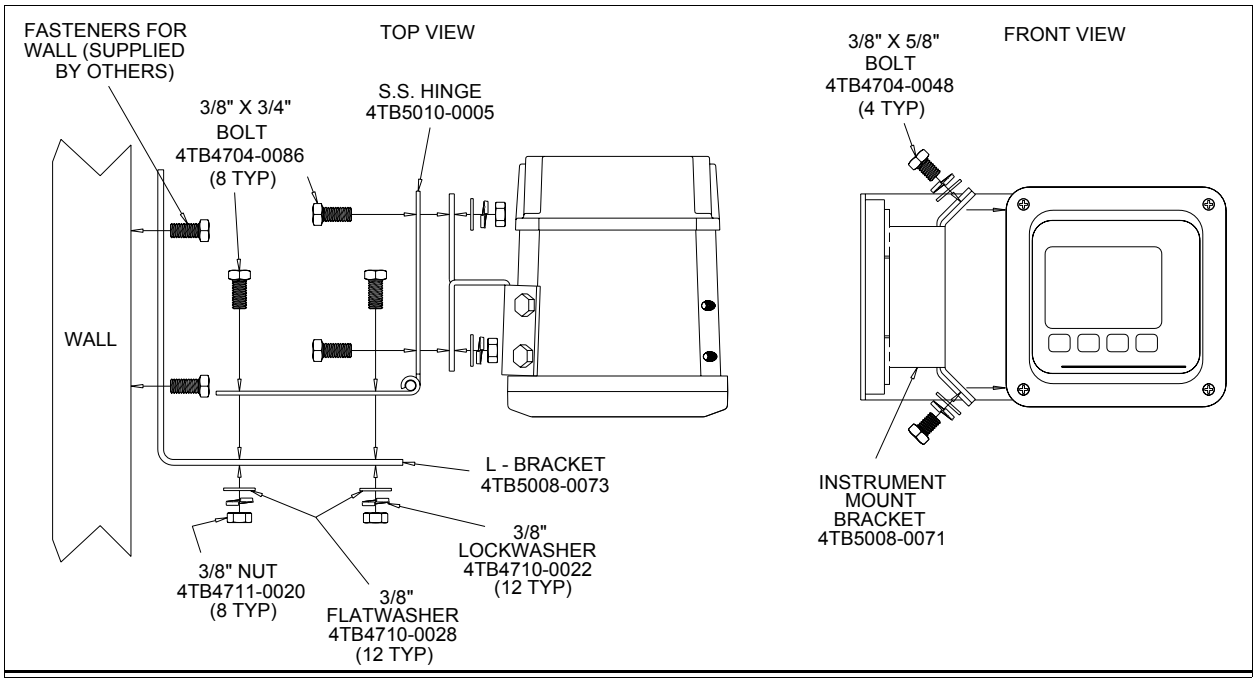


Figure 3-3. Hinge Mount Installation Diagram

Wall Mounting

The TB84PH Wall Mount Kit (p/n 4TB9515-0156) contains an instrument mounting bracket with associated hardware. Wall mounting accommodates installations where the analyzer can be positioned for a clear line of sight and free access to the rear terminations. These types of installation include supporting beams, flange brackets, and wall ends.

Using Figure 3-4 as a reference, mount the TB84PH analyzer as follows:

1) Select the desired location and orientation of the TB84PH analyzer.

2) Attach the instrument mount bracket to the selected location using the appropriate type of fastener based on the mounting surface material.

3) Attach the instrument to the instrument mounting bracket using the supplied 3/8" x 5/8" bolts, 3/8" flat washers, and 3/8" lock washers.

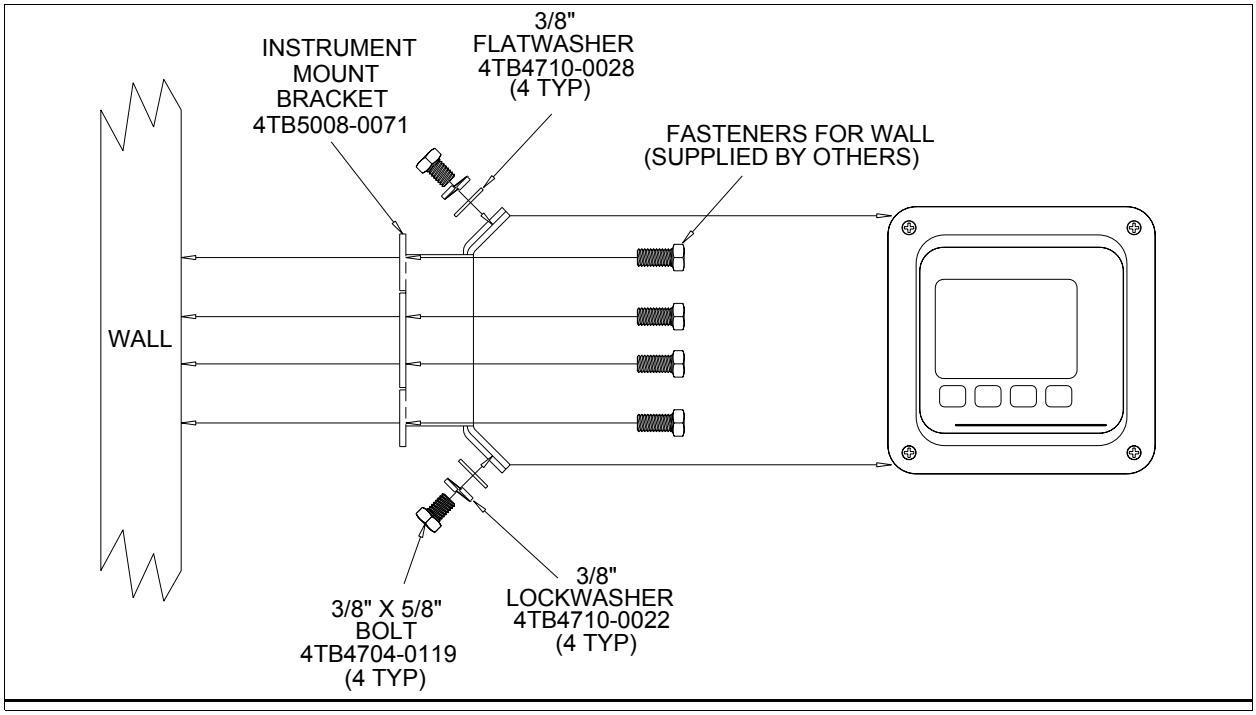


Figure 3-4. Wall Mount Installation Diagram

Panel Mounting

The TB84PH Panel Mount Kit (p/n 4TB9515-0123) contains four panel bracket assemblies and a panel gasket. The TB84PH enclosure conforms with DIN sizing and requires a 135.4 mm x 135.4 mm cut-out for panel mounting. The panel brackets accommodate a maximum panel thickness of 3/8".

Using Figure 3-5 as a reference, mount the TB84PH analyzer as follows:

1) Select the desired location of the TB84PH analyzer.

2) Cut a 135.4 mm x 135.4 mm hole with diagonal corners through the panel as shown in Figure 3-5.

3) Install the panel gasket onto the instrument.

4) Remove Rear Cover if necessary, and insert the instrument through the panel cut-out.

5) Attach the panel mounting bracket assembly to all four corners of the analyzer.

6) Tighten the adjustment screws on the panel mounting brackets until the analyzer seats against the panel. Note, do not over-tighten the adjustment screws or damage to the brackets and panel may result.

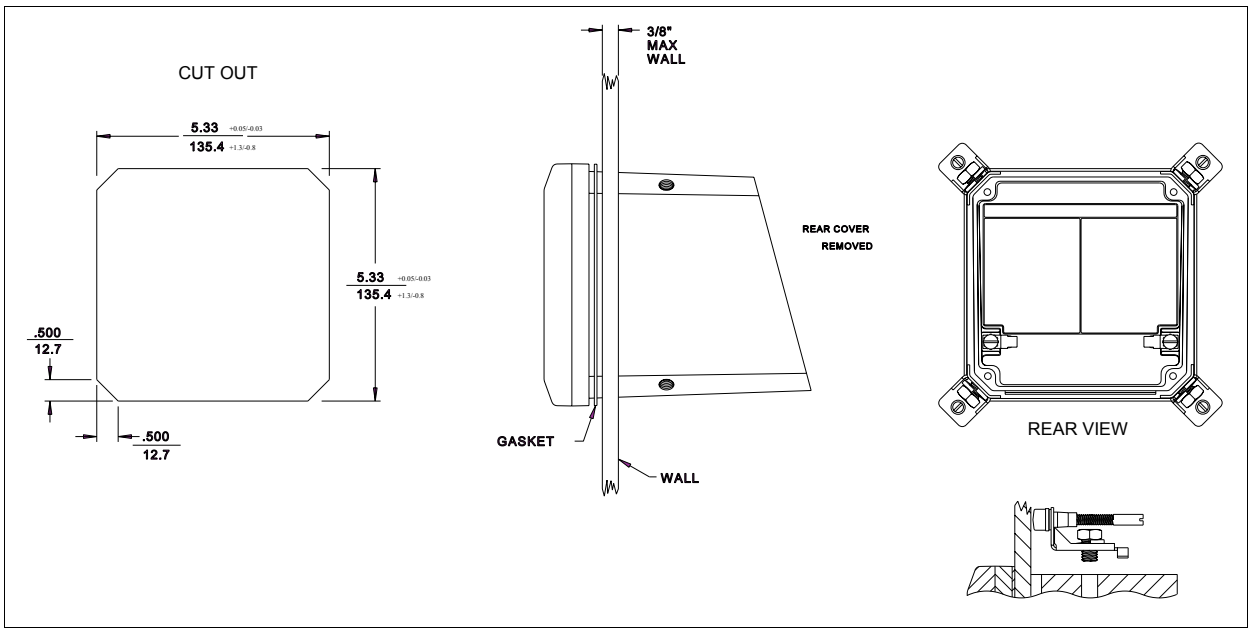


Figure 3-5. Panel Mount Installation Diagram

WIRING CONNECTIONS AND CABLING

CAUTION	**To prevent possible signal degradation, separate metal conduit runs are recommended for the sensor, signal, and power wiring.**

Under ideal conditions, the use of conduit and shielded wire may not be required. However, to avoid noise problems, power, signal, and output wiring should be enclosed in separate conduit. Just prior to entering the housing, rigid conduit should be terminated and a short length of flexible conduit should be installed to reduce any stress to the housing.

Note: To maintain a NEMA 4X/IP65 rating, use approved conduct connections or cord grips that have the same type of ratings.

Power and signal wiring must bear a suitable voltage rating, have a maximum temperature rating of 75°C (167°F), and must be in accordance with all NEC requirements or equivalent for the installation site. Use either a standard three-prong grounded flexible CSA certified line cord or equivalent for power supply connection or hard wire directly to the AC supply. If hard wiring the AC power supply, use stranded, 14 AWG copper conductor wire.

Signal wiring should not be run in the same conduit or open trays where power wiring for high amperage electrical equipment exists. Ensure the final installation of signal and power wiring prevents physical and/or electrical interfere.

Note: Use weatherproof connections for all wiring ports. Heyco RLTF ½" and LTF 9 cable grips are available through ABB Inc.. See Section 17, Support Services.

The TB84PH Advantage Series analyzer accepts wire sizes 12 to 24 AWG. Signal wiring should always be twisted, shielded pairs to ensure the best performance. Pin-style terminals are recommended for all connections and available as kits from the factory. See section 17, Support Services, for more information.

Power Wiring

WARNING **Disconnect the AC line cord or power lines from the operating branch circuit coming from the source before attempting electrical connections. Instruments powered by AC line voltage constitute a potential for personnel injury due to electric shock.**

WARNING **Keep the enclosure and covers in place after completing the wiring procedures and during normal operation. Do not disconnect or connect wiring or remove or insert printed circuit boards unless power has been removed and the flammable atmosphere is known NOT to be present. These procedures are not considered normal operation. The enclosure prevents operator access to energized components and to those that can cause ignition capable arcs. Failure to follow this warning can lead to unsafe conditions that can injure personnel and damage equipment.**

The TB84PH Advantage Series analyzer does not require pre-setting a jumper to accept different line-power voltages. Power connections are located in the back of the instrument housing. The terminal block label identifies all line power, output signal, and sensor connections.

Notes:
1. ABB recommends installing a power line switch for safety purposes and for providing power-up and power-down convenience when servicing the analyzer.

2. Do not power the system from a transformer that also powers large motor loads (over five horsepower) or any other type of equipment that generates line voltage surges, sags and excessive noise.

Using Figure 3-7 as a reference, make line power connections as follows:

1) Strip wire insulation back approximately 0.250" (seven millimeters) to ensure the bare wire will make good contact with the Insulated Pin Lug terminals and will not be exposed beyond the pin insulator.

2) Crimp Pin Lug terminals to wire using Panaduit CT 570 or equivalent.

3) Connect the specified line voltage to TB1-1 (Line - L1), the neutral to TB1-2 (Neutral - L2), and the ground to terminal TB1-3 (Chassis Ground).

Analog Output Signal Wiring

The terminal block label identifies the analog output connections. Terminal polarity is shown and must be observed to ensure proper operation. The maximum load resistance for the analog outputs is specified in Table 1-3, Specifications. The maximum load resistance must include all devices and wiring within the analog output current loop. See Figure 3-7 for a wiring diagram.

Using Figure 3-7 as a reference, make analog output connections as follows:

1) Strip wire insulation back approximately 0.250" (seven millimeters) to ensure the bare wire will make good contact with the Insulated Pin Lug terminals and will not be exposed beyond the pin insulator.

2) Crimp Pin Lug terminals to the wire using Panaduit CT 570 or equivalent.

3) Connect the wiring to the appropriate analog output terminals.

Relay Output Signal Wiring

The relay outputs are shipped from the factory in the default state of Normally Open. That is, the relay contacts will be open when the relay is not energized. To change the normal state of any of the three relay outputs, switches on the power supply PCB assembly must be moved to different positions.

Using Figure 3-6 as a reference, change the normal state of any relay output as follows:

1) Unscrew the four captive screws located at the four corners of the Front Bezel Assembly.

2) Lightly pull the Front Bezel Assembly from the Shell Assembly.

3) Identify the Power Supply PCB Assembly and relay state switches using Figure 3-6.

4) Move the switch position to the desired the desired normal state (i.e., Normally Open or Normally Closed.)

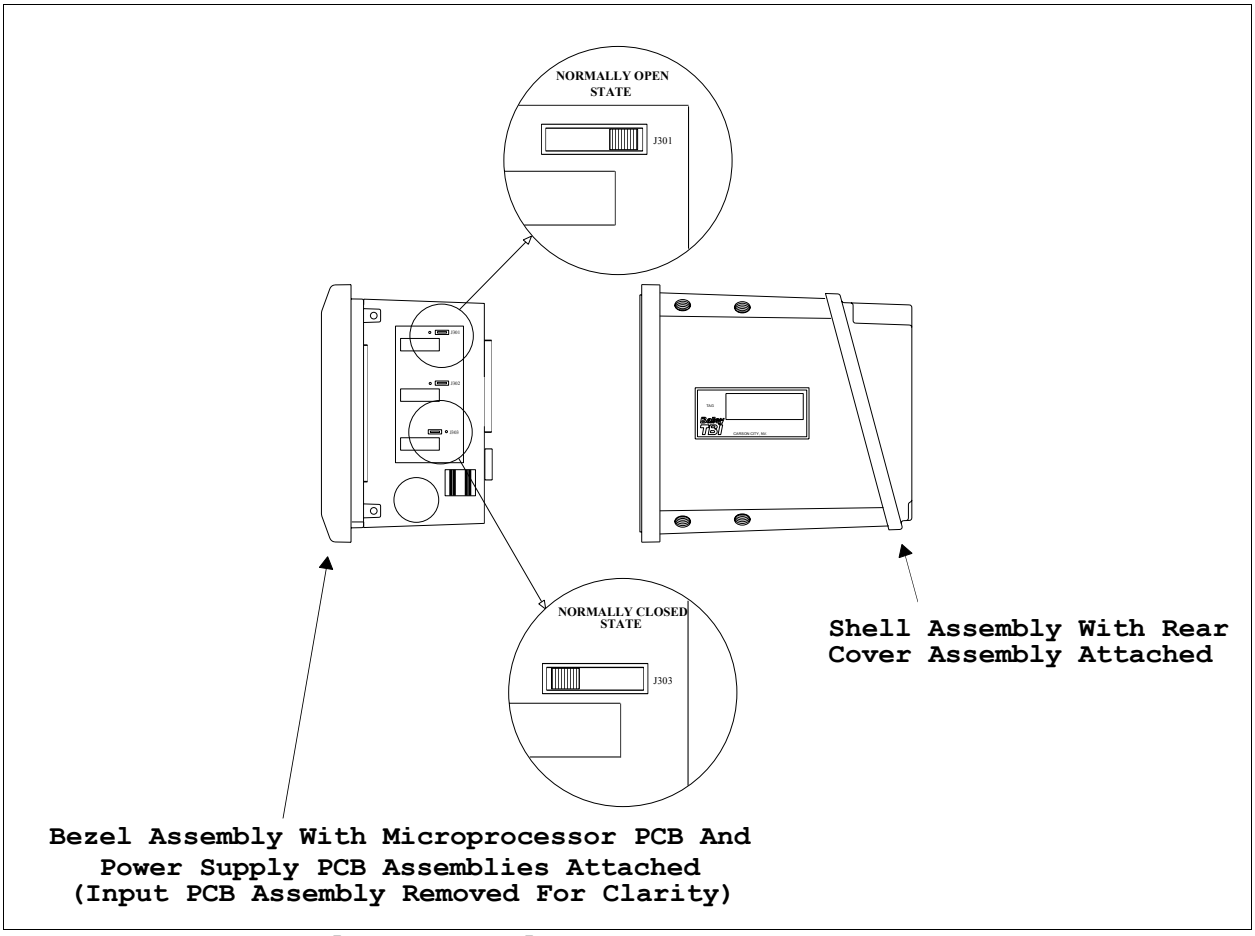


Figure 3-6. Normal State Relay Jumper Location.

Using Figure 3-7 as a reference, make relay output connections as follows:

1) Strip wire insulation back approximately 0.250" (seven millimeters) to ensure the bare wire will make good contact with the Insulated Pin Lug terminals and will not be exposed beyond the pin insulator.

2) Crimp Pin Lug terminals to the wire using Panaduit CT 570 or equivalent.

3) Connect the wiring to the appropriate relay output terminals.

Advantage Series (TBX5) Sensor Wiring

Instrument connections for the sensor wiring are located next to the signal connections. Sensor wiring should be run in shielded conduit, or similar, for protection from environmental influences. Do not allow the wires to become wet. The wiring should not lay on the ground or over any other equipment. Ensure cables are not abraded, pinched or bent during the installation process or during normal operation.

The sensor cable has seven leads with pin terminals that must be connected to the terminal block in the rear cavity of the TB84PH Advantage Series analyzer. The seven leads are color coded and have the following functions and connections:

Terminal Block Location	Sensor Color Code	Function
TB2-1	Blue	Sense
TB2-2	Yellow	Guard
TB2-3	Black	Reference
TB2-4	Green	Solution Ground
TB2-5	Red	RTD
TB2-6	White	RTD
TB2-7	Hvy Grn	Shield
TB2-8	N/A	N/A

Remove the protective insulator from the Black lead before installing it into the analyzer's terminal block. The insulator has been provided to prevent shorting of the sensor half-cell. Shorting of this conductor will

permanently damage the sensor.

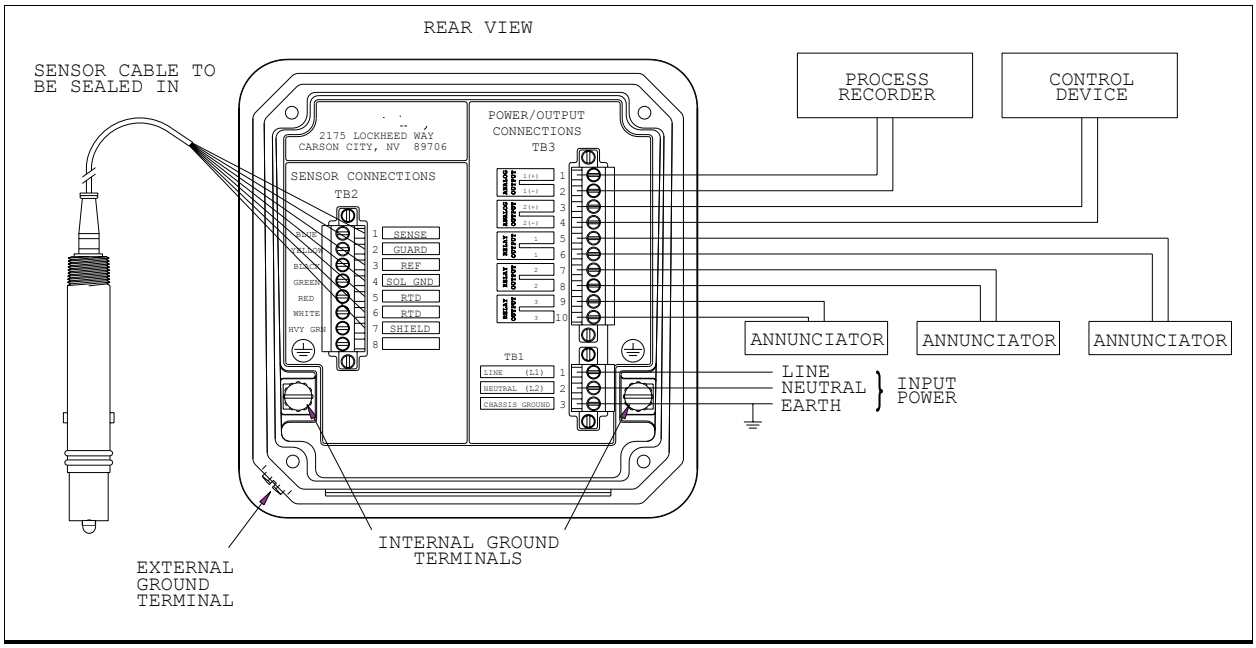


Figure 3-7. Instrument Wiring Diagram.

Non-Advantage Series (TB5) Sensor Wiring

For standard and Next Step ABB sensors (i.e., TB5), a pin terminal option is available for installation to a TB84PH Advantage Series analyzer. Though this cable option is recommended when using a non-Advantage Series sensor, stocking preferences may tend towards the use of one common sensor. If this sensor type requires a BNC connector to mate with existing instrumentation, a BNC Adapter (included with all TB84PH Advantage Series analyzers) provides such a connection.

When using the pin terminal sensor cable option (i.e., the T[][] nomenclature option where [][] represents the cable length), connect color coded leads to the analyzer's terminal block as follows:

Terminal Block Location	Sensor Color Code	Function
TB2-1	Blue	Sense
TB2-2	N/A	Guard
TB2-3	Black	Reference
TB2-4	N/A	Solution Ground
TB2-5	Red (If Applicable)*	RTD

TB2-6	White (If Applicable)*	RTD
TB2-7	N/A	Shield
TB2-8	N/A	N/A

* Note: Red and White conductors will only be present if a temperature compensator is being using.

Since pH/ORP/pION sensor cables generally contain a low-noise conductive layer within the coax, complete removal of this layer is extremely important to ensure correct sensor operation. Additionally, most conductors within the sensor cable are small and are not recommended to be used directly in the TB84PH Advantage Series' terminal blocks; therefore, the BNC Adapter (p/n 4TB9515-0164 or 4TB9515-0166) is recommended over removing the BNC and stripping back each of the individual conductors.

Using Figure 3-8 as a reference, install the BNC Adapter and connect the BNC-type sensor as follows:

1) Remove the earth ground screw and hardware located below the SENSOR CONNECTIONS terminal block.

2) Slide the earth ground screw (and remaining hardware if desired) through the screw hole on the BNC Adapter so that the adapter's leads and female BNC are pointing upwards.

3) Mount the BNC Adapter to the available threaded earth ground hole.

4) Connect the BNC Adapter pin terminals to the corresponding SENSOR CONNECTIONS terminal block locations via the conductor color coding.

Note: If the sensor does not have a female connector for the Temperature Compensator (TC), connect the leads from the sensor directly to the terminal block locations TB2-5 and TB2-6 (i.e., Red and White). For sensors without TC, leave TB2-5 and TB2-6 open.

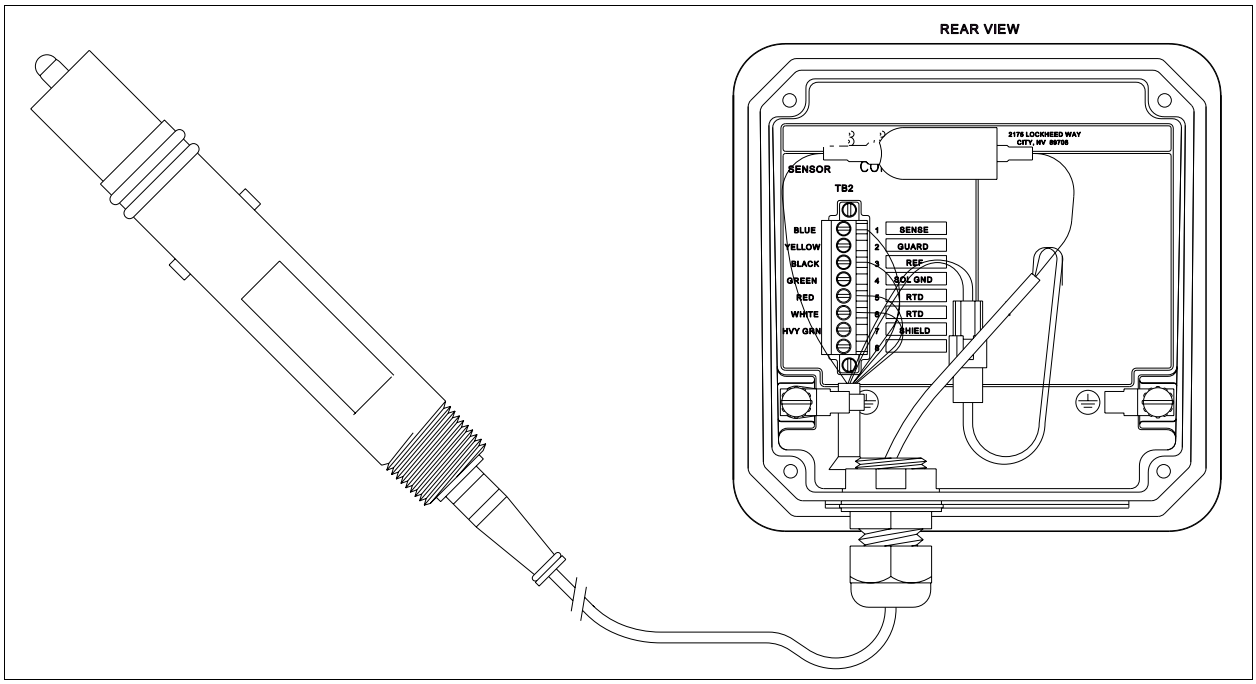


Figure 3-8. BNC Adapter Installation and Wiring Diagram

5) Connect the male BNC from the sensor to the female BNC from the BNC Adapter and the female TC connector from the sensor to the male TC connector from the BNC Adapter.

6) Slide the protective boot over the BNC connection to prevent any possible shorting to earth surfaces.

Note, if the BNC surface is in contact with a earth ground surface, a ground loop through the sensor may occur and could result in poor sensor performance and shortened sensor life.

GROUNDING

The customer and/or wiring contractor is responsible to ensure that the analyzer, associated control or test equipment, and all exposed conductive materials are properly grounded. Grounding procedures should be in accordance with local regulations such as the National Electrical Code (NEC), Canadian Electrical Code (CEC), or equivalent. Equipment installation must not pose a hazard, including under fault conditions, to operation and service personnel.

Signal wiring should be grounded at any one point in the signal loop or may be ungrounded (floating) if electrical noise is minimal.

The analyzer enclosure must be grounded to an earth ground having less than 0.2 ohms of resistance. Internal and external earth ground terminals are provided and shown in Figure 3-7.

Notes:

1. Because of the prevailing differences in soil conditions and in acceptable grounding practices throughout the world, the scope of this product instruction does not intended to be used to describe grounding electrode systems. The customer is responsible to ensure a grounding electrode system is acceptable to the local building and wiring codes.

2. Using the structural metal frame of a building as the required equipment grounding conductor for the analyzer is not advised.

OTHER EQUIPMENT INTERFACE

The TB84PH Advantage Series analyzer provides two isolated current outputs that are proportional to the process variable(s). Since the analyzer output is isolated, each current loop may have a maximum of one non-isolated device within its circuit. The maximum load on the each current loop must not exceed the specification listed in Table 3-1, Specifications.

INSTRUMENT ROTATION

The TB84PH Advantage Series analyzer has four pairs of threaded mounting holes in enclosure. Since these holes are located at the corners of the instrument, the TB84PH Advantage Series analyzer can be positioned in any of the four positions as demonstrated in Figure 3-9.

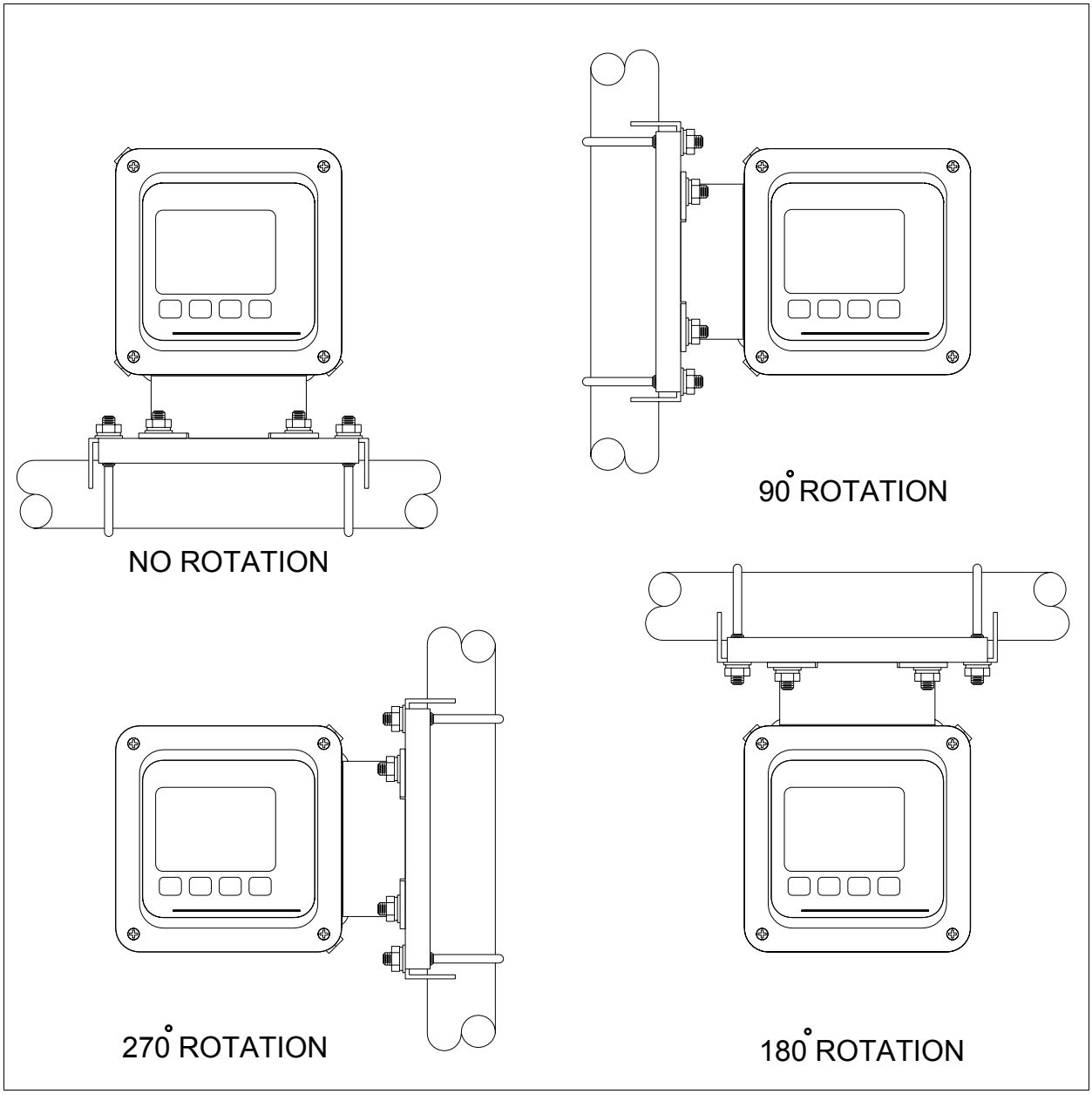


Figure 3-9. Mounting Rotation (Pipe Mount Shown)

SECTION 4 - OPERATING PROCEDURES

INTRODUCTION

The TB84PH Advantage Series analyzer has seven main operating modes: Measure, Calibration, Output/Hold, Configuration, Security, secondary Display, and Setpoint/Tune. Within each mode, several programming states containing functions specific to the related mode are available.

The TB84PH Advantage Series analyzer is equipped with a built-in user interface through which all analyzer functions are programmed or monitored. In order to maximize the viewing area and minimize the space needed for the keypad, the interface is based on a custom LCD that contains a group of two or more icons for each button on the four button keypad. Each icon represent a key function that is energized when that function is required (patent-pending).

Two display regions in the custom LCD handle the majority of instrument functions. These regions include a primary display area for the process variable (e.g., pH) and a secondary display area for programming text prompts or auxiliary information.

In addition to the user-friendly interface, the TB84PH Advantage Series analyzer is equipped with a group of icons that alerts the user to an existing FAULT condition, diagnostic SPIKE output, output HOLD condition, or activated RELAY. These icons are located at the top of the LCD and are only energized when the specified condition is detected. FAULT conditions are shown in the secondary display using the FAULT INFO key when the instrument is in the Measure Mode of Operation.

Liquid Crystal Display (LCD)

The LCD contains nine regions that provide the user with information on the process variable, engineering units, mode of operation, output hold condition, fault indication, relay activation, secondary variable, and key function assignments. Figure 4-1 shows a fully energized LCD, Smart Keys, and mode text.

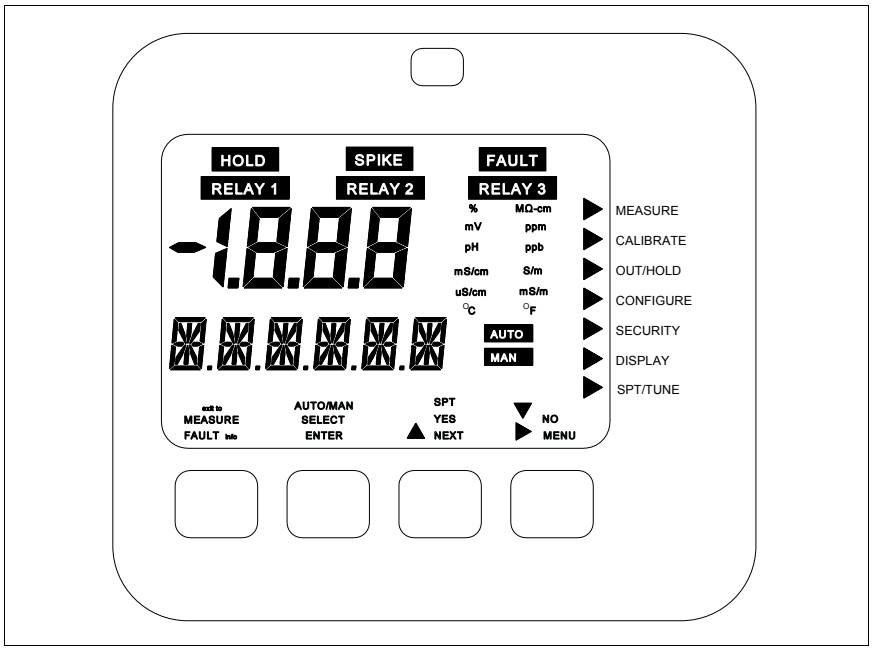


Figure 4-1. Fully Energized Display And Supporting Information.

The top set of icons informs the user of an abnormal operating condition such as a output HOLD condition, FAULT condition, diagnostic SPIKE output, or RELAY activation. These icons are only energized when such a condition is detected and are active in all modes of operation.

For the mode of operation indicators (shown as right arrows grouped next to the mode text), only one indicator will be lit and will indicate the current mode of operation of the analyzer. As a user moves from one mode to the next, the appropriate indicator will energize. The mode of operation indicators are active in all modes of operation.

The process variable is displayed in the three and one-half digit, seven segment region.

This display region is supported by the engineering unit region. These regions are active in all modes of operation; however, in some programming states, the process variable region will be used for data entry and the engineering unit region will reflect the data unit.

The secondary variable is displayed in the six-character, fourteen segment region. This display region is used for displaying secondary information and fault information in the Measure Mode of Operation and textual prompting in all other modes of operation. Due to the limited number of characters for this display region, much of the prompting takes the form of text abbreviations (see Appendix B for a list of abbreviations.) This region is active in all modes of operation.

The Smart Key assignments are grouped into four sets of icons, each group directly positioned above one of the four keys. These icons are textual representations of the function for the associated key. Only one assignment will be energized per Smart Key at any given time.

Multi-Function Smart Keys

A five-button, tactile keypad is located on the front panel of the instrument. Four of the gray buttons are embossed to easily show their location. A fifth, hidden button located at the top of the NT in the text ADVANTAGE has been included to provide access to functions that are infrequently used.

The four embossed keys are called Smart Keys since their functions are dependent on the mode and/or state of the instrument. Since these four keys do not have a preassigned function, icons are energized over the key to indicate its function. If a Smart Key does not have an icon energized above its location, this Smart Key does not have a function and will not initiate an action when pressed. Using this Smart Key method, a smaller number of keys can be used without complicating instrument functionality.

Table 4-1. Smart Key Definition of Operation

Icon	Smart Key Function
exit to MEASURE	Escapes back to the Measure Mode from all other modes or programming states of operation. This function is not available in the Measure Mode.
FAULT info	Accesses information on diagnostic problem or error conditions. Displays this information as a short text string and code. This function is only available in the Measure Mode.
AUTO/MAN	Not used at this time.
SELECT	Selects the mode or programming state of operation shown in the secondary display region.
ENTER	Stores configured items and data into permanent memory.
SPT	A shortcut key to the Setpoint/Tune Mode of Operation. This function is only active in the Measure Mode.
YES	Affirms the action that is about to take place.
▲	Increments numeric values or moves through a series of parameters.
NEXT	Increments through a series of programming states.
▼	Decrements numeric values or moves through a series of parameters.
NO	Denies the action that is about to take place.
▶	Moves the flashing data entry value one space to the right.
MENU	Increments through the modes of operation.

For each operating mode and/or state, pressing the Smart Key initiates the displayed function of that Smart Key. For example, the function NEXT allows a user to cycle through a series of programming states for a given mode of operation. The function SELECT enables the user to enter into the displayed mode or state of operation. Using this method, the TB84PH Advantage Series analyzer guides the user through the necessary steps use to program or monitor any given function. A general description of each Smart Key function is

given in Table 4-1.

MODES OF OPERATION

The Measure Mode is the normal operating mode of the TB84PH Advantage Series analyzer and is the default mode upon power-up. The Measure Mode is the starting point for entry into other modes of operation. Each mode contains a unique set of analyzer functions or states. These modes and their related functions are listed in Table 4-2.

Table 4-2. Mode of Operation Definitions

MODE	FUNCTION
Measure	Used to display the process and secondary variables - the normal operating mode for the analyzer.
Calibrate	Used to calibrate input and analog output functions.
Out/Hold	Used for on-line tuning of analog output parameters or to manually set the analyzer analog outputs, for example, during maintenance.
Configure	Used to configure analyzer functions such as temperature compensation, temperature sensor type, and measurement electrode type.
Security	Used to enter password protection for the Calibrate, Out/Hold, Configure, and Setpoint/Tune Modes of Operation.
Display	Used to select the variable that will be shown in the secondary display region when the analyzer is in the Measure Mode of Operation.
SPT/Tune	Used for on-line tuning of relay output parameters.

HOLD ICON

The Hold icon energizes when a hold condition is active. Outputs can be either manually or automatically held.

Manual activation is accessible in the Output/Hold Mode of Operation. In this mode, the Hold State permits the output to be held at the current level and/or state or at a level and/or state manually set by the user.

Automatic activation occurs during a Two-Point Process Variable Calibration and Cleaner activation. For the Two-Point Process Variable Calibration, the analyzer will automatically hold all outputs at the current levels and states. Upon completing the two-point calibration, the TB84PH Advantage Series analyzer will query the user to either release or maintain the hold condition.

For a relay output configured as a Cleaner, a user has the option to enable an automatic hold condition using the levels and states capture directly before initiating the cleaning operation. The hold condition only occurs during the relay on and recovery times and can be separately set for the analog and relay outputs. If desired, the relay outputs can be disabled instead of held during a cleaning cycle.

FAULT ICON

The Fault icon energizes when a fault condition has been detected by the TB84PH Advantage Series analyzer. Fault conditions include all problem and error detection as outlined in Section 13, Diagnostics.

SPIKE ICON

The Spike Output function modulates Analog Output One from the normal level representative of the process variable to a value configured as a set percentage of output current. When the TB84PH Advantage Series analyzer has detected a fault condition and the Spike Output function has been enabled, Analog Output One will begin to modulate and the Spike icon will energize. For more information on Spike Output and Fault conditions, see Section 13, Diagnostics.

RELAY ICONS

The Relay icons are composed of three individual icons. Each icon represents the specified relay (i.e., Relay One, Relay Two, and Relay Three.) When a relay change state from its normal state to an energize state, the corresponding Relay icon also energizes. Since the normal state of each relay can be set by a switch, the relay icon will only inform the user of a state change and not whether the relay has closed or opened.

SECTION 5 - MEASURE MODE

INTRODUCTION

The Measure Mode is the normal operating mode of the analyzer and is the active mode upon analyzer power-up. In this mode, the process variable, output hold state, fault condition state, spike output state, relay output states, and secondary display information are displayed. From the Measure Mode, other modes of operation and fault information can be accessed.

BOREDOM SWITCH

When a user enters an operating mode or state and does not return to the Measure Mode as the final step, the TB84PH Advantage Series analyzer automatically returns to the Measure Mode of Operation after 20 minutes of unattended use. This feature ensures the analyzer will always be returned to its normal mode of operation.

PRIMARY DISPLAY

The primary display shows the process variable. The value of this variable is dependent on the configured analyzer, temperature compensation type, temperature value, sensor output, and damping value. The engineering units for the process variable are dependent only on the configured analyzer. Table 5-1 lists the analyzer types and corresponding engineering units.

Table 5-1. Engineering Unit And Analyzer Relationship

ANALYZER TYPE	ENGINEERING UNIT
pH	• pH
ORP	• mV (millivolts)
pION	• mV (millivolts)
ION CON (pION Concentration)	• ppm (parts per million) • ppb (parts per billion) • % (percent) • User Defined

SECONDARY DISPLAY

The secondary display has the ability to show a large variety of information. Since the display area only has six characters, only one item can be shown at any given time.

Typically, this region will be used for displaying the process temperature in degrees Celsius; however, it can be changed to display the process temperature in degrees Fahrenheit, output current in milliamperes (i.e., mA) for each analog output (shown separately), reference impedance in kohms, sensor output in millivolts (i.e., mV), and firmware revision. See Section 10, Secondary Display, for more information.

FAULT INFORMATION Smart Key

Fault information can only be accessed from the Measure Mode of Operation and is interrogated using the FAULT Info Smart Key. A fault condition causes the FAULT icon to blink and the FAULT Info Smart Key to appear. These indicators will be energized as long as the fault condition is present.

When pressing the FAULT Info Smart Key, the first fault condition will be shown in the secondary display. A short text string followed by the fault code will be sequentially shown. Depressing the FAULT Info Smart Key progressively moves from one fault to the next until all faults have been shown. Once all faults have been interrogated, the FAULT icon will no longer blink and remains energized until all fault conditions have been removed. If a new fault condition is detected, the FAULT icon will begin to blink to inform the user of the newly detected condition. For more information on fault conditions and codes, see Section 13, Diagnostics.

SPT Smart Key

The SPT or Setpoint Smart Key provides a short-cut directly to the SPT/TUNE Mode of Operation. This short-cut provides quick access to tunable relay parameters.

MENU Smart Key

The MENU Smart Key provides access to all other modes of operation. By pressing the MENU Smart Key, the analyzer moves from one mode of operation to the next. Visual feedback is provided in two manners: the mode indication arrow moves to the next mode of operation(e.g., Calibrate) and the secondary display shows the text string representative of that mode (e.g., CALIBR). Access into the

displayed mode of operation is achieved by using the SELECT Smart Key. An escape function to the Measure Mode of Operation is provided using the Exit to MEASURE Smart Key.

As seen by the detailed screen flow diagram shown in Figure 5-1, pressing the MENU Smart Key when in the Measure Mode moves the user to the Calibrate Mode. Once in the Calibrate Mode, pressing the Exit to MEASURE Smart Key returns the analyzer back to the Measure Mode, pressing the SELECT Smart Key moves the analyzer into the Calibrate States of Operation, and pressing the MENU Smart Key moves the analyzer to the Output/Hold Mode of Operation. Use Figure 5-1 to identify the Smart Key assignments and the resulting action.

Since each mode of operation contains many operation states used to set or tune the TB84PH Advantage Series analyzer functions, the following sections of this product instruction manual contain detailed descriptions of each mode of operation. Screen flow diagrams showing the programming text prompts, Smart Key assignment, and the resulting action for each Smart Key are also included. Refer to Appendix B for programming text string definitions and a programming function tree showing the relationship of all modes and states of operation.

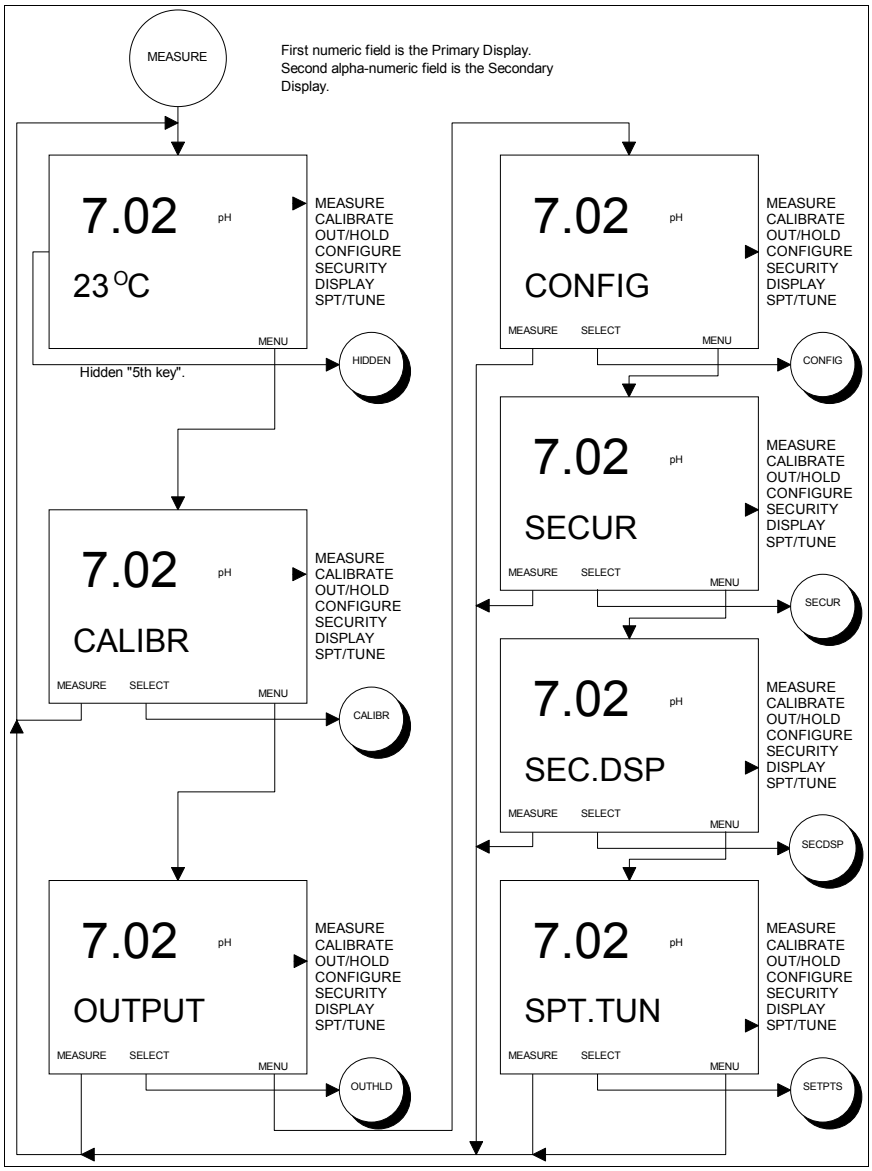


Figure 5-1. Screen Flow Diagram For Mode of Operation.

SECTION 6 - CALIBRATE MODE

INTRODUCTION

The Calibrate Mode of Operation provides the ability to calibrate the sensor input, temperature input, and analyzer outputs. These functions (i.e., Calibrate States of Operation) include process variable, temperature, edit, reset, and output calibration.

CALIBRATE STATES OF OPERATION

The Calibrate Mode consists of six states of operation. Table 6-1 describes the function of each state of operation.

Table 6-1. Calibrate States

State	Function
PH.CAL ORP.CAL ION.CAL	Used to calibrate the input from the process sensor using a one-point offset or two-point offset/efficiency calibration.
TMP.CAL	Used to calibrate the input from the temperature sensor using a one-point smart calibration that adjusts the offset, slope, or both based on sensor calibration history.
EDT.CAL	Used to manually adjust the process sensor offset and efficiency and temperature sensor offset and slope values.
RST.CAL	Used to restore calibration values for the process variable and temperature back to factory settings.
AO1.CAL	Used to calibrate Analog Output One. Requires an external validation device.
AO2.CAL	Used to calibrate Analog Output Two. Requires an external validation device.

When in the Calibrate Mode, the NEXT Smart Key provides access to all Calibrate States. Pressing the NEXT Smart Key sequentially moves the user through each Calibrate State. This cycle repeats until a Calibrate State is selected using the SELECT Smart Key, or the

escape function is chosen using the Exit To MEASURE Smart Key. Use Figure 6-1 to identify the Smart Key assignments and the resulting action.

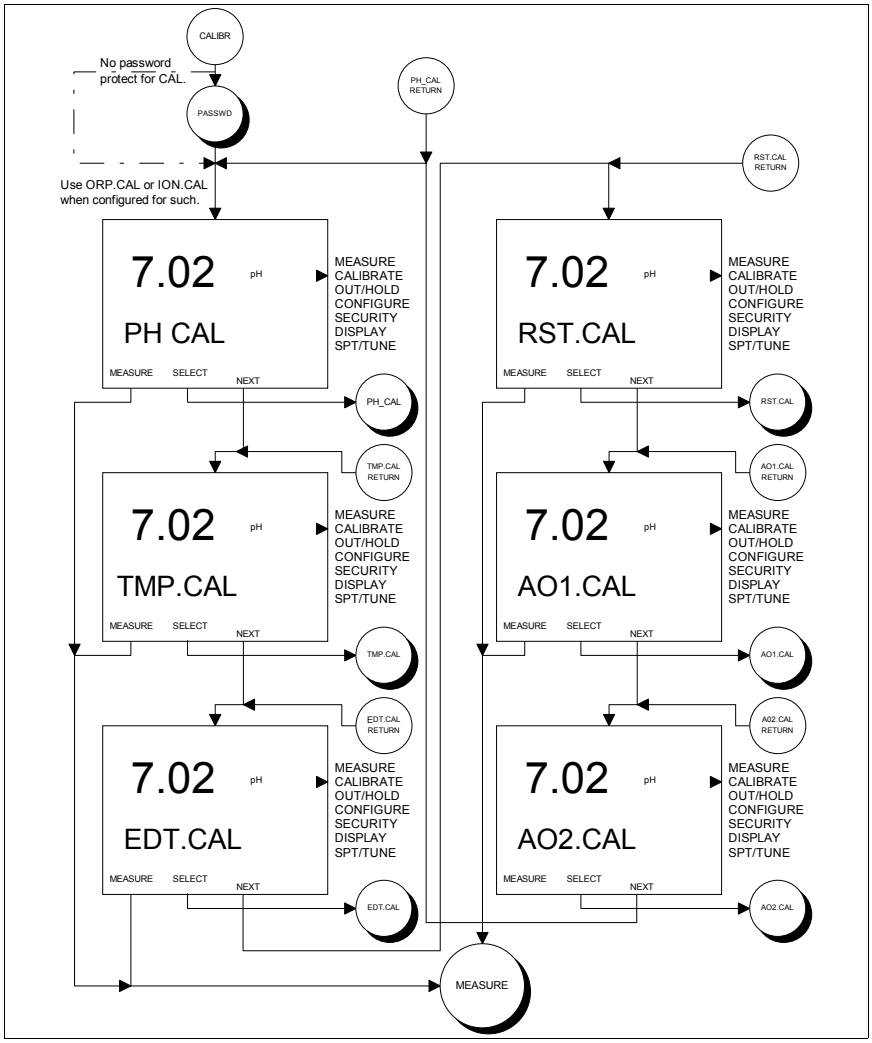


Figure 6-1. Screen Flow Diagram For Calibrate States of Operation.

The following subsections contain detailed descriptions of each Calibrate State of Operation.

Process Sensor Calibrate State

The Process Sensor Calibrate State contains two calibration procedures:

1) 1PT.CAL (One-Point Calibration) and
2) 2PT.CAL (Two-Point Calibration).

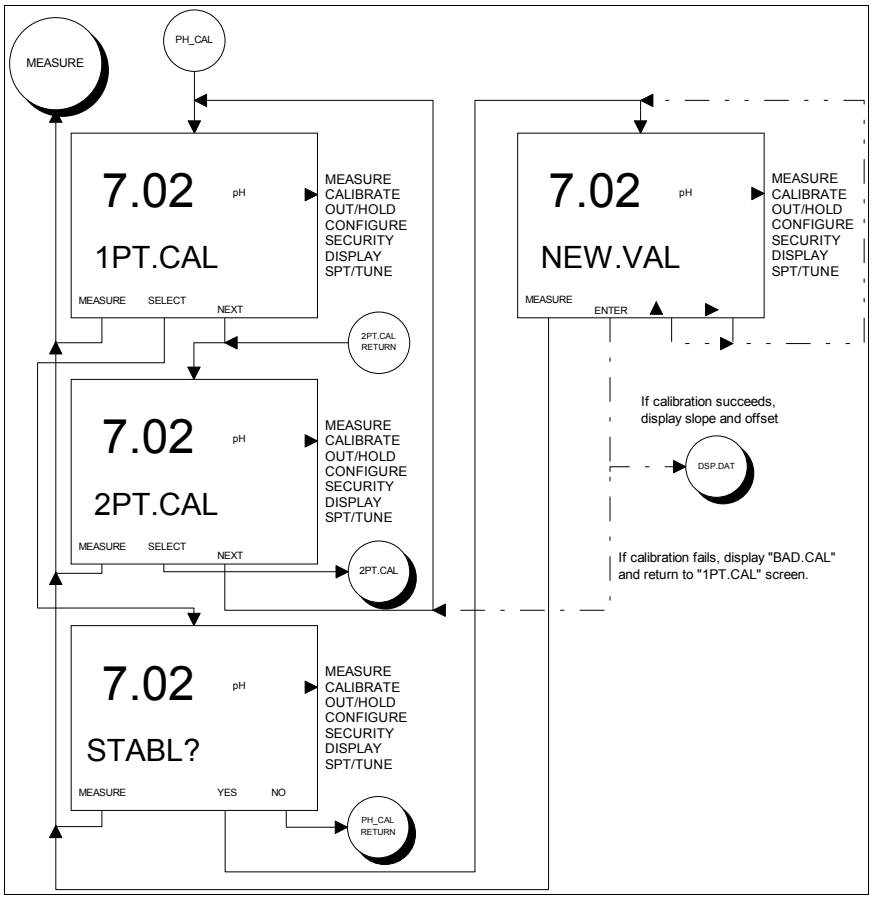


Figure 6-2. Screen Flow Diagram For Process Sensor Calibrate State of Operation.

As with the other states of operation, the two calibration procedures can be toggled by using the NEXT Smart Key, selected by using the SELECT Smart Key, and escaped by using the Exit To MEASURE Smart Key.

Use Figure 6-2 to identify the Smart Key assignments and the resulting action.

One-Point Calibrate State

Due to variations in ionic strength between the sensor reference and process liquid, improved accuracy can be realized by conducting a one-point calibration with the sensor in its final location. Typically, the analyzer is verified against an external validation device using a grab sample. The One-Point Calibrate State conducts an offset adjustment on the sensor input.

Conduct a One-Point Calibration using Figure 6-2 as a reference and the following procedure:

1) Select the 1PT.CAL in the Process Sensor Calibrate State of Operation using the SELECT Key.

2) Verify the process variable value using an external instrument having the same type of temperature compensation and a grab sample.

3) Confirm the TB84PH Advantage Series analyzer displayed reading is STABL? (i.e., stable) using either the YES or NO Key. If the NO Key is pressed, the analyzer will return to the Process Sensor Calibrate State. For an unstable condition, conduct one or more of the following steps:

    a) Wait until process liquid composition stabilizes,
    b) Check to see if the TB84 Advantage Series analyzer has detected a Fault condition by looking for the Fault icon on the LCD. Interrogate the fault by escaping to the Measure Mode using the Exit to MEASURE Key and the FAULT Info Key in that order.
    c) See Section 14, Troubleshooting.

4) If the reading was stable, enter the NEW VAL (i.e., new process variable) that reflects the difference between the grab sample value and the indicated value when the grab sample was taken (i.e., Current TB84PH Indication + [Grab Sample Value - TB84PH Indication at the time the grab sample was taken]). Use the ▲ Key to increment the digit value and the ▶ Key to move to the next digit. Press the ENTER Key to enter the new value.

Invalid calibration values will generate the text string BAD.CAL, and the calibration value will not be accepted. If the new value is valid, the Efficiency (i.e., slope value shown as a percentage of theoretical) will be shown. Pressing the NEXT Smart Key displays the Offset value. At this point, the user can return to the Process Sensor Calibrate State by pressing the NEXT Smart Key or to the Measure Mode by pressing the Exit To MEASURE Smart Key.

Note: If a Hold condition is present, the TB84PH Advantage Series analyzer inquires if this condition should be released.

For more information on sensor calibration techniques and troubleshooting, refer to TP90-2.

Two-Point Calibrate State

The Two-Point Calibrate State conducts offset and slope adjustments on the sensor input to determine its response characteristics. This calibration is typically conducted before installation into its final location and periodically during the life of the sensor when the response of the sensor begins to decrease. This calibration procedure uses buffers or standards depending on the type of sensor (e.g., pH versus pION, respectively).

When conducting a Two-Point Calibration, the TB84PH Advantage Series analyzer initiates an automatic Hold All condition. The Hold icon will begin to flash, and the Hold All condition will remain active until the calibration is complete.

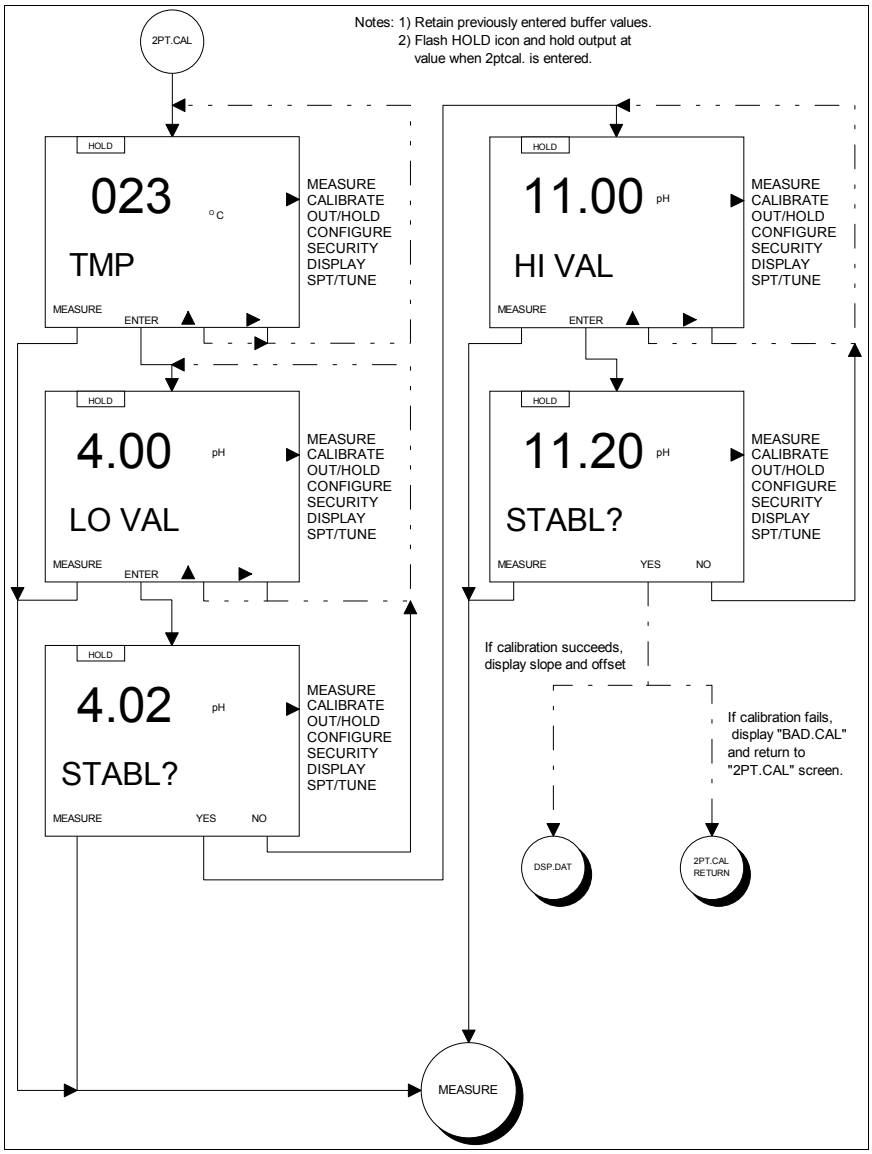


Figure 6-3. Screen Flow Diagram For Two-Point Process Calibration.

Conduct a Two-Point Calibration using Figure 6-3 as a reference and the following procedure:

1) Prepare the Buffer Solutions.

2) Select the 2PT.CAL in the Process Sensor Calibrate State of Operation using the SELECT Key.

3) Remove the sensor from the process piping if required.

4) Enter the TMP°C (i.e, temperature in degrees Celsius) of the buffer or standard solution using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit. Press the ENTER Key to enter the new value.

5) Enter the LO VAL (i.e., low buffer or standard value) using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit. Press the ENTER Key to enter the new value.

6) Place the sensor in the low buffer or standard solution and stir the solution with the sensor in a slow, circular motion.

7) Once the reading is stable, confirm by using either the YES or NO Key at the STABL? (i.e., stable) text prompt.

8) Enter the HI VAL (i.e., high buffer or standard value) using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit. Press the ENTER Key to enter the new value.

9) Remove the sensor from the low buffer or standard solution, rinse the sensor, and place the sensor in the high buffer or standard solution and stir the solution with the sensor in a slow, circular motion.

10) Once the reading is stable, confirm by using the YES or NO Key at the STABL? (i.e., stable) text prompt.

Invalid calibration values will generate the text string BAD.CAL, and the calibration value will not be accepted. If the values are valid, the Efficiency (i.e., slope value shown as a percentage of theoretical) will be shown. Pressing the NEXT Smart Key displays the Offset value. At this point, the user can return to the Process Sensor Calibrate State by pressing the NEXT Smart Key or to the Measure Mode by pressing the Exit To MEASURE Smart Key.

Note: If a Hold condition is present, the TB84PH Advantage Series analyzer inquires if this condition should be released.

For more information on sensor calibration techniques and troubleshooting, refer to TP90-2.

Temperature Calibrate State

The Temperature Calibrate State is a smart calibration routine that allows for both single- and dual-point calibration. By calibrating the temperature at two points which are at least 20°C apart, the TB84PH Advantage Series analyzer automatically adjusts the offset and/or slope. Since this routine only uses the most recent calibration data, calibrations can be conducted throughout the sensor's life to ensure accurate measurement of the temperature sensing device. If an incorrect calibration has been entered, the Reset Calibrate State can restore the calibration to factory settings. See Reset Calibrate State in this section.

Note: The Reset Calibrate State will reset all calibration values including the process sensor; therefore, the process sensor will require calibration after performing the Reset Calibration procedure.

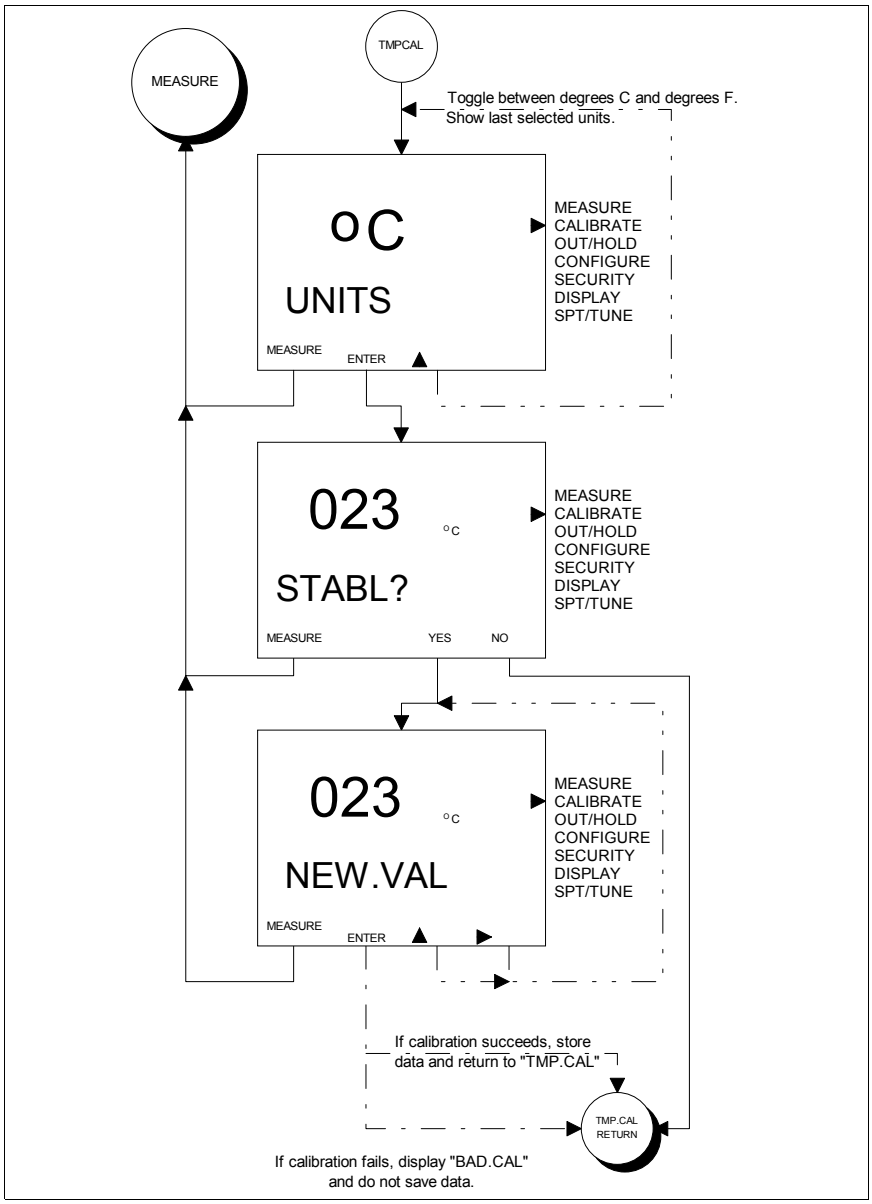


Figure 6-4. Screen Flow Diagram For Temperature Calibrate State of Operation.

Conduct a Temperature Calibration using Figure 6-3 and the following procedure:

1) Before installing the sensor into its final installed location, allow the sensor to reach ambient temperature.

2) Select the Temperature Calibrate State of Operation using the SELECT Key.

3) Set the engineering unit by pressing the ▲ Key to toggle the unit between °C (i.e., degrees Celsius) or °F (i.e., degrees Fahrenheit), and press the ENTER Key to use the displayed engineering unit.

4) Confirm the displayed reading is STABL? (i.e., stable) using either the YES or NO Key. If the NO Key is pressed, the TB84PH Advantage Series analyzer will return to the Temperature Calibrate State. For an unstable condition, conduct one or more of the following steps:

   a) Wait until the temperature stabilizes,
   b) Check to see if the TB84PH Advantage Series analyzer has detected a Fault condition by looking for the Fault icon on the LCD. Interrogate the fault by escaping to the Measure Mode through the Exit to MEASURE Key and the FAULT Info Key in that order.
   c) See Section 14, Troubleshooting.

5) If the reading was stable, enter the temperature as the NEW VAL (i.e., new temperature value) using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit. Press the ENTER Key to enter the new value.

6) Repeat steps 1 through 5 once the sensor has been mounted in its final installed location; however, use the process fluid temperature as the NEW VAL.

Edit Calibrate State

The Edit Calibrate State allows a user to manually adjust the sensor and temperature slope and offset values. Though this function may not be suitable for many applications, this Calibrate State facilitates quick and easy access to these calibration values for troubleshooting purposes.

Conduct an Edit Calibration using the following procedure.

1) Select the Edit Calibrate State of Operation using the SELECT Key.

2) Edit the sensor PV SLP (i.e., efficiency)

value using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit. Press the ENTER Key to enter the new value or to proceed to the sensor offset value. Press the Exit To MEASURE Key to escape to the Measure Mode. Valid slope values range from 40 to 150%.

3) Edit the sensor PV OFF (i.e., offset) value using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit. Press the ENTER Key to enter the new value or to proceed to the temperature slope value. Press the Exit To MEASURE Key to escape to the Measure Mode. Valid offset values range from -1000 to +1000 millivolts.

4) Edit the temperature TMP.SLP value using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit. Press the ENTER Key to enter the new value or to proceed to the temperature offset value. Press the Exit To MEASURE Key to escape to the Measure Mode. Valid slope values range from 0.2 to 1.5.

5) Edit the temperature TMP.OFF value using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit. Press the ENTER Key to enter the new value or to proceed to the Edit Calibrate State. Press the Exit To MEASURE Key to escape to the Measure Mode. Valid offset values range from -40 to +40°C.

Reset Calibrate State

The Reset Calibrate State sets all calibration data (i.e., sensor and temperature) to factory values. This state purges calibration history and should be initiated before calibrating a new sensor.

When interrogating the calibration values after a reset has been performed, the slope and offset values for both the sensor and temperature will be set to 100%/1.000 and 000 millivolts/000°C, respectively.

Conduct a Reset Calibration using the following procedure.

1) Select the Reset Calibrate State of Operation using the SELECT Key.

2) Confirm or refuse the RESET? operation using either the YES or NO Key, respectively.

Note: The Reset Calibration State will reset all calibration values; therefore, the process sensor and temperature sensor will require calibration after performing the Reset Calibration procedure.

Analog Output One Calibrate State

The Analog Output One Calibrate State trims the output signal to maintain precise transmission of the process variable to the final monitoring system. Though the TB84PH Advantage Series analyzer output current is factory calibrated, the output can be trimmed to compensate for other Input/Output devices.

Conduct an Output Calibration using the following procedure.

1) Select the Output Calibrate State of Operation using the SELECT Key.

2) Use the ▲ or ▼ Keys to increase or decrease the 0 or 4 milliampere output signal. Press the ENTER Key to enter the new value or to proceed to the 20 milliampere output level.

3) Use the ▲ or ▼ Keys to increase or decrease the 20 milliampere output signal. Press the ENTER Key to enter the new value or to proceed to the Output Calibrate State.

Note: If the output level has been adjusted and the adjusted level has been entered using the Enter Key, this adjusted value will be permanently stored. To rectify a bad calibration, the output calibration procedure must be repeated.

Analog Output Two Calibrate State

The Analog Output Two Calibrate State trims the output signal to maintain precise transmission of the process variable to the final monitoring system. Though the TB84PH Advantage Series analyzer output current is factory calibrated, the output can be trimmed to compensate for other Input/Output devices.

Conduct an Output Calibration using the following procedure.

1) Select the Output Calibrate State of Operation using the SELECT Key.

2) Use the ▲ or ▼ Keys to increase or decrease the 0 or 4 milliampere output signal. Press the ENTER Key to enter the new value or to proceed to the 20 milliampere output level.

3) Use the ▲ or ▼ Keys to increase or decrease the 20 milliampere output signal. Press the ENTER Key to enter the new value or to proceed to the Output Calibrate State.

Note: If the output level has been adjusted and the adjusted level has been entered using the Enter Key, this adjusted value will be permanently stored. To rectify a bad calibration, the output calibration procedure must be repeated.

SECTION 7 - OUTPUT/HOLD MODE

INTRODUCTION

The Output/Hold Mode of Operation provides the ability to set the outputs to fixed levels and/or states, change the output ranges, damp the output signals, or disable the diagnostic spike.

OUTPUT/HOLD STATES OF OPERATION

The Output/Hold Mode consists of six states of operation. Table 7-1 describes the function of each state of operation.

Table 7-1. Output/Hold States

State	Function
HOLD	Used to fix output levels and/or states to values captured when the hold was initiated or to manually entered values, or used to release an existing output HOLD state.
AO1.RNG	Used to change Analog Output One range.
AO2.RNG	Used to change Analog Output Two range.
DAMPNG	Used to reduce fluctuation in the displayed values and/or output signals.
SPIKE	Used to enable or disable the spike output function if configured.

In the Output/Hold Mode, the NEXT Smart Key sequentially moves the user to all other Output/Hold States. The cycle repeats until an Output/Hold State is selected using the SELECT Smart Key or the escape function is chosen using the Exit To MEASURE Smart Key. Use Figure 7-1 to identify Smart Key assignments and the resulting action.

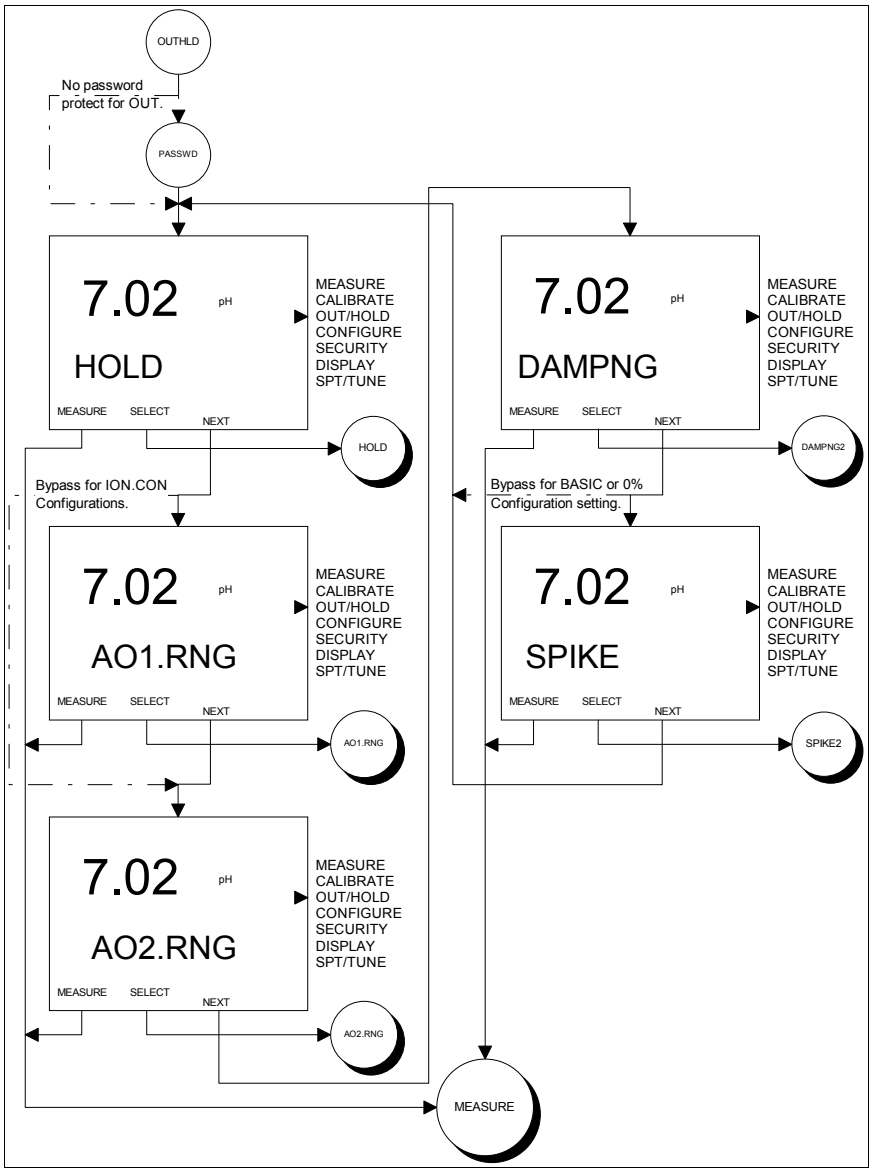


Figure 7-1. Screen Flow Diagrams For Output/Hold States of Operation.

The following subsections contain detailed descriptions of each Output/Hold State of Operation.

Hold/Release Hold Output State

The Hold Output State allows a user to fix the analog and relay outputs to captured levels and states or to manually set levels and states, or to release all previously held levels or states.

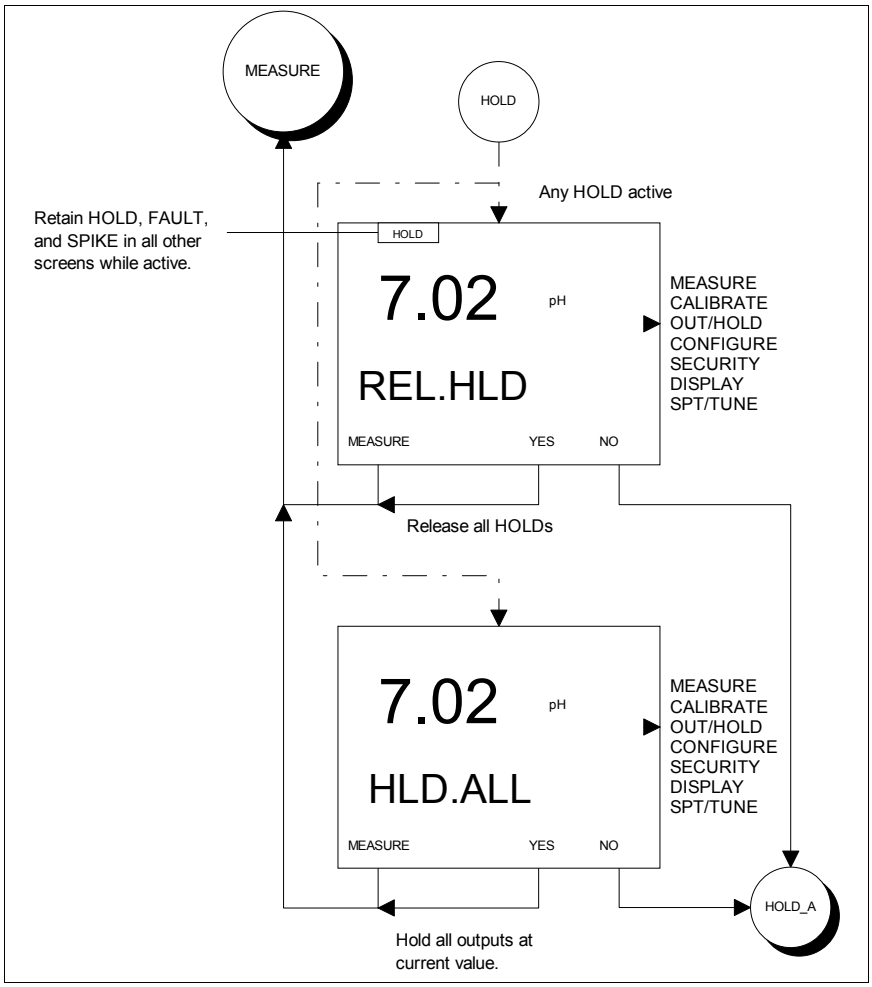


Figure 7-2. Screen Flow Diagrams For Hold State of Operation.

As seen by Figure 7-1, an active Hold condition can be completely removed or manually altered. If a Hold condition is not active, the option to Hold All (i.e., HLD.ALL) is given. In the latter case, confirmation of this action using the YES Key causes the TB84PH Advantage Series analyzer to hold all analog and relay outputs at the levels and states captured when confirmation is made.

If a Hold All or Release Hold action in not confirmed by using the NO Key, each output can be independently held to the capture level/state or to a manually set level/state. Figure 7-3 and 7-4 show the programming prompts, smart key assignments, and resulting actions.

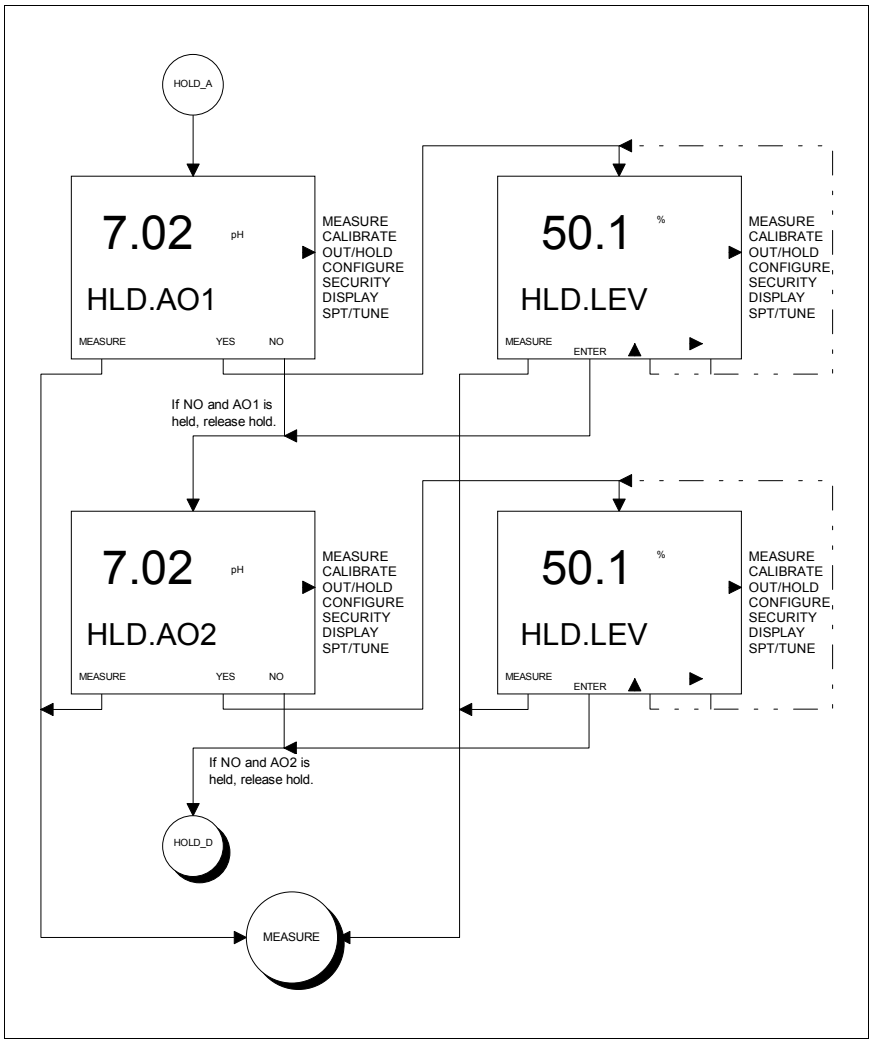


Figure 7-3. Screen Flow Diagram For Setting Specific Analog Output Hold Levels.

As seen by Figures 7-3 and 7-4, any single or combination of analog and relay outputs can be held to any specified level or state, respectively. A Hold condition is commissioned using the YES Key and declined using the NO Key. The hold level and/or state is set using the arrow(s) and Enter Keys.

Initiate a Hold Output condition using Figures 7-2, 7-3, and 7-4 as references and the following procedure:

1) Select the Hold State of Operation using the SELECT Key.

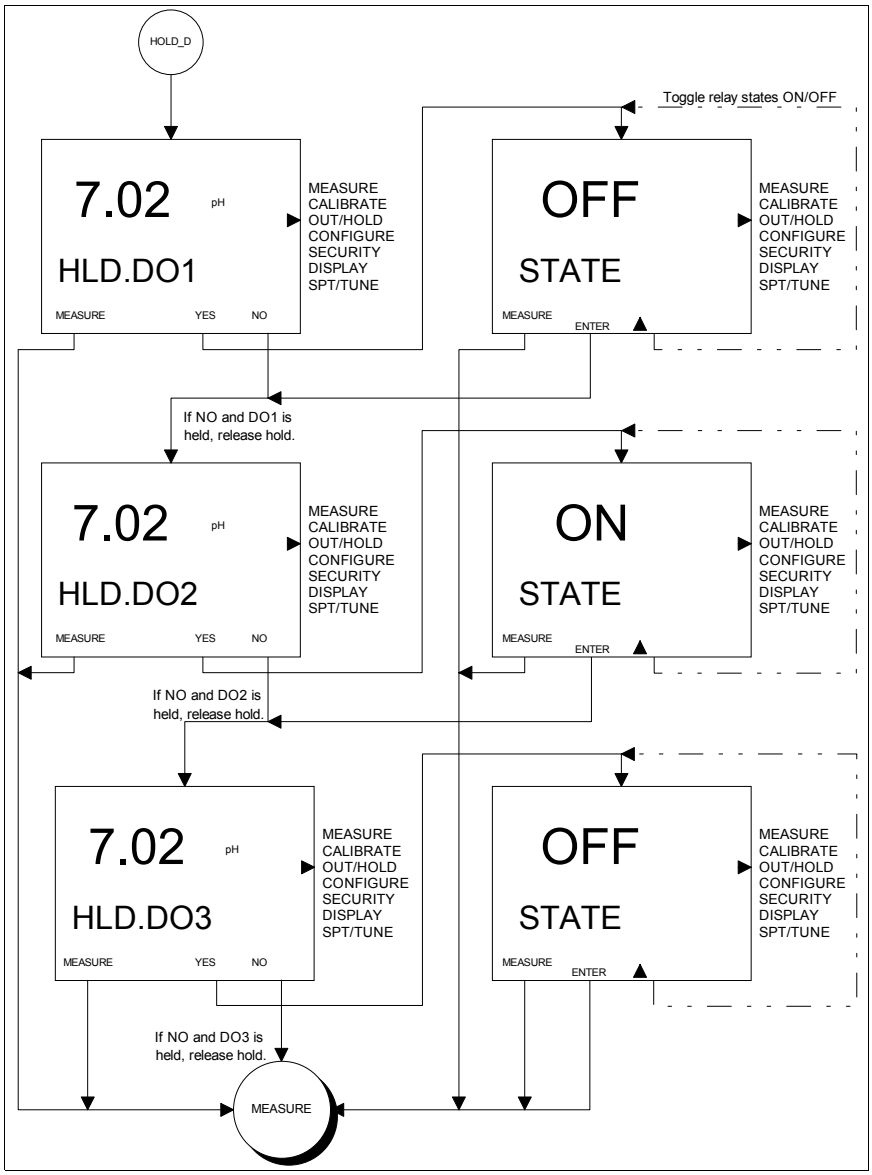


Figure 7-4. Screen Flow Diagram For Setting Specific Relay Output States.

2) Hold all (i.e., HLD.ALL) outputs by pressing the YES Key, or hold specific outputs using the NO Key. Press the Exit To MEASURE Key to escape to the Measure Mode.

3) For each output, use the YES Key to hold the indicated output or the NO Key to release the indicated output. Press the Exit To MEASURE Key to escape to the Measure Mode.

4) For held analog outputs, set the hold value using the ▲ Key to increment the

blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to enter the new value. Press the Exit To MEASURE Key to escape to the Measure Mode.

5) For held relay outputs, toggle the relay to the desired state (i.e., OFF or ON) using the ▲ Key, and press the ENTER Key to enter the new value. Press the Exit To MEASURE Key to escape to the Measure Mode.

Note: If the YES key was used to commission a hold condition on any output, initiating the escape function will not affect the commissioned Hold condition. To release this Hold condition, the Hold State must be re-enter and the Hold condition released either by using the YES Key when requested to release all hold conditions(i.e., REL.HLD) or by removing the hold condition using the NO Key when individually setting each output.

If a hold condition(s) already exists and the user selects the Hold State of Operation, the TB84PH Advantage Series analyzer will request whether all hold conditions should be released (i.e., REL.HLD). Press the YES Key if all hold conditions should be released and the NO Key to edit the existing hold conditions.

Analog Output One Rerange State

The Analog Output One Rerange Output/Hold State provides the ability to change the output range of Analog Output One. One or both end point values can be changed to any value or range of values that are within the specifications listed in Table 1-3.

If a non-linear output is configured, reranging the end point values will affect the non-linear relationship. Since the non-linear relationship is set as a percentage input against a percentage output, changing the end point values should accompany a review of the break point relationship. See Section 8, Configure Mode, for information on viewing and modifying the non-linear break points.

Conduct a Rerange of the output values using the following procedure:

1) Select the Rerange State of Operation using the SELECT Key.

2) Edit the process variable value for the zero or four milliampere point

(determined by the analyzer's configuration) using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit and press the ENTER Key to enter the new value, or press the ENTER Key to continue to the 20 milliampere value. Press the Exit To MEASURE Key to escape to the Measure Mode.

3) Press the ENTER or Exit To MEASURE Key to escape to the Measure Mode, or edit the process variable value for the 20 milliampere point using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit and press the ENTER Key to enter the new value.

Note: If 1)the zero or four milliampere value is changed, 2)the new value is valid per the specification in Table 1-3, 3)this change is accepted using the Enter Key, and 4)the user escapes to the Measure Mode using the Exit To Measure Key without adjusting the 20 milliampere value, the output range will now reflect the newly entered zero or four milliampere point.

Analog Output Two Rerange State

The Analog Output Two Rerange Output/Hold State provides the ability to change the output range of Analog Output Two. One or both end point values can be changed to any value or range of values that are within the specifications listed in Table 1-3.

Conduct a Rerange of the output values using the following procedure:

1) Select the Rerange State of Operation using the SELECT Key.

2) Edit the process variable value for the zero or four milliampere point (determined by the analyzer's configuration) using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit and press the ENTER Key to enter the new value, or press the ENTER Key to continue to the 20 milliampere value. Press the Exit To MEASURE Key to escape to the Measure Mode.

3) Press the ENTER or Exit To MEASURE Key to escape to the Measure Mode, or edit the process variable value for the 20 milliampere point using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit and press the ENTER Key to enter the new value.

Note: If 1)the zero or four milliampere value is changed, 2)the new value is valid per the specification in Table 1-3, 3)this change is accepted using the Enter Key, and 4)the user escapes to the Measure Mode using the Exit To Measure Key without adjusting the 20 milliampere value, the output range will now reflect the newly entered zero or four milliampere point.

Damping State

The Damping State applies a lag function on the input signal for Basic configuration or can apply different lag functions to the display process variable, Analog Output One, and Analog Output Two for Advanced configurations. The Damping function reduces the fluctuations caused by erratic process conditions. Damping value can be set from 0.0 to 99.9 seconds and represents the time required to reach 63.2% of a step change.

For Basic configurations, the damping value is applied to the analyzer's input signals. In this case, damping will be applied to the displayed process variables and analog outputs. For Advanced configurations, different damping values can be applied to each output element (i.e., the displayed process variables, Analog Output One, and Analog Output Two.)

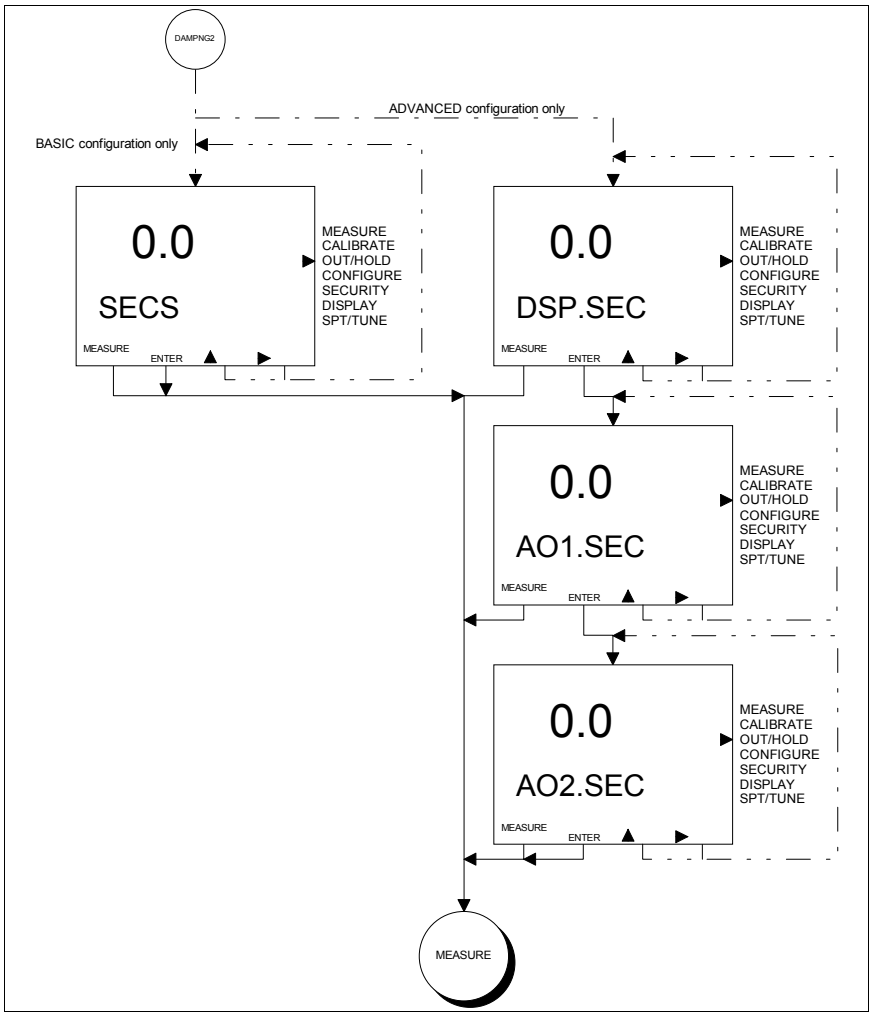


Figure 7-5. Screen Flow Diagram For Output/Hold Damping State

Apply Damping on the outputs using Figure 7-5 as a reference and the following procedure:

1) Select the Damping State of Operation using the SELECT Key.

2) Edit the new damping value using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit and press the ENTER Key to enter the new value. Press the Exit To MEASURE Key to escape to the Measure Mode.

Spike State

The Spike State toggles the operational state of the spike output function. The spike function modulates the current output on Analog Output One by the amount established in the analyzer configuration. See Section 2, Analyzer Functionality And Operator Interface Controls, and Section 8, Configure Mode, for more information.

Toggle the Spike output using the following procedure:

1) Select the Spike State of Operation using the SELECT Key.

2) Toggle the spike output function to the desired state (i.e., OFF or ON) using the ▲ Key, and press the ENTER Key to accept. Press the Exit To MEASURE Key to escape to the Measure Mode.

Note: Once the Spike State is OFF, changing the configured spike level in the Configure Mode will not re-enable the Spike State. The Spike State can only be turned ON or OFF in the Output/Hold Mode of Operation.

SECTION 8 - CONFIGURE MODE

INTRODUCTION

The Configure Mode of Operation establishes the operating parameters of the TB84PH Advantage Series analyzer. These parameters include programming type, analyzer type, sensor type, temperature compensation type, analog output ranges, relay output parameters, damping value(s), diagnostic functionality, safe mode levels, and spike magnitude (i.e., level).

A description of each configuration item and related parameters will be included. Review each of the following sections before configuring the TB84PH Advantage Series analyzer.

PRECONFIGURATION DATA REQUIRED

Before attempting to configure the TB84PH Advantage Series analyzer, the following requirements must be defined.

1. Analyzer parameters.
2. Analog Output Range values.
3. Relay Output function and parameters.
4. Security requirements.
5. Sensor Diagnostic functionality.

Use the worksheets found in Appendix C to help establish the proper settings for any given application. Use these sheets during the configuration entry procedure and retain them as a historical record for future reference.

CONFIGURE VIEW/MODIFY STATE

Upon selecting the Configure Mode of Operation, a decision point is reached to Modify or View the configuration of the TB84PH Advantage Series analyzer. The Modify Configure State enables analyzer options to be set and saved into memory. In order to provide the ability to secure the Modify Configure State yet leave the ability to view configuration information, the View Configure State can be entered without using a security code.

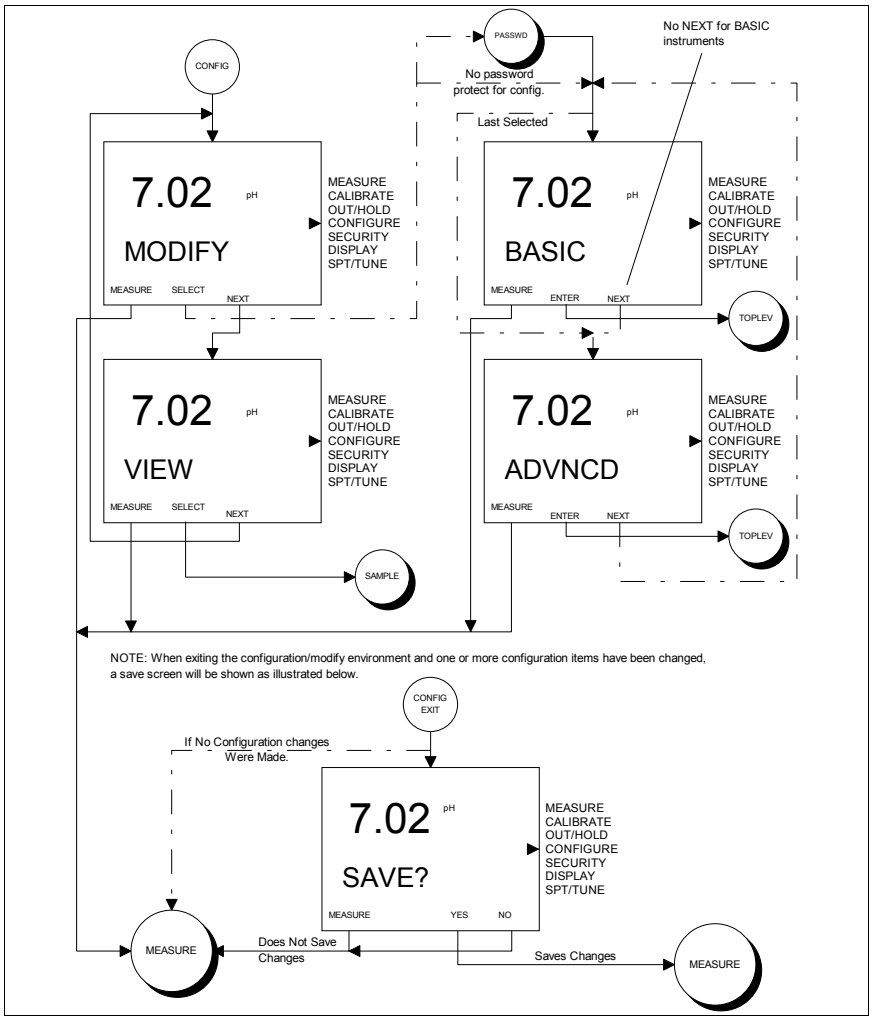


Figure 8-1. Screen Flow Diagram For Modify/View and Basic/Advanced Configure States of Operation

As seen in Figure 8-1, the TB84PH Advantage Series analyzer queries if the user would like to Modify the configuration. Pressing the YES Smart Key moves the user into the Modify Configure State, pressing the NO Smart Key moves the user to the View configuration query, and pressing the Exit To MEASURE Smart Key escapes to the Measure Mode.

If a configuration requires modification and the user is in the View Configure State, access to the Modify Configure State is provided through a HotKey function. The HotKey links the View Configure State to the Modify Configured State using the ENTER Smart Key. For example, the TMP.SNS (i.e., temperature sensor) in the View Configure State can be modified from PT 100 to None by

pressing the ENTER Smart Key when viewing the PT 100 option. An intermediate confirmation screen will query the user on their desire to modify this option using the YES and NO Smart Keys. If the Modify Configure State has been secured, the security code will be requested. Upon entering the correct code or if the Modify Configure State has not been secured, the TB84PH Advantage Series analyzer will go directly to TMP.SNS Modify Configure State and allow the user to change the temperature sensor type. After completing the change, pressing Exit To MEASURE Smart Key moves the user to the configuration SAVE? State. Pressing the YES Smart Key saves the new temperature sensor option and returns the analyzer to the Measure Mode.

BASIC/ADVANCED PROGRAMMING MODE

The Configure Mode is split into two programming groups: Basic and Advanced. These two options are specified by nomenclature and control the number of configuration options available in the Modify Configure State.

The Basic Programming Mode contains a subset of configuration options found in the Advanced mode. Separation into two programming groups is advantageous when limited functionality is desired. Fewer options reduces confusion and the possibility of configuration errors.

When Advanced programming is ordered, the programming toggle (i.e., Basic/Advanced) must be set in two locations: the User State in the Utility Mode and the Modify Configure State in the Configure Mode. In order to select either the Basic or Advanced Programming Mode in the Modify Configure State, the Programming Mode must be set to Advanced in the User State. See Section 11, Utility Mode, for more information on setting the User State programming mode to Advanced.

When in the Configure Mode and Advanced programming has been set in the User State, the TB84PH Advantage Series analyzer queries if the user would like Basic programming. Pressing the ENTER Smart Key moves the user to the Modify Configure States, pressing the NEXT Smart Key moves the user to the Advanced programming query, and pressing the Exit To MEASURE Smart Key escapes to the Measure Mode. To set the analyzer to Advanced programming, the user presses the ENTER Smart Key when queried to set the programming to Advanced.

See Figure 8-1 for the corresponding screen flows.

MODIFY CONFIGURE STATES OF OPERATION

Since the View Configure State only displays the configured options, the following sections will strictly focus on each Modify Configure State and the available options for these states.

The Modify Configure State contains all the available settings that establishes the functionality of the TB84PH Advantage Series analyzer. Upon receipt of the analyzer, the default configuration (unless otherwise specified by the customer when ordering the TB84PH Advantage Series analyzer) will be used once the analyzer has been powered. See the Preface or Appendix C for the default configuration settings.

Before installing the analyzer, the configuration should be modified to reflect the final installed application. The Modify Configure States define the sensor interface, output parameters, and diagnostic functionality. Table 8-1 describes each of these programming modes and their function.

Table 8-1. Modify Configure States

State	Function	Programming Mode
ANALZER	Used to define the type of analyzer. Choices include pH, ORP, pION, and Ion Concentration (ION.CON).	Basic/Advanced
TMP.SNS	Used to define the type of temperature sensor. Choices include None, Pt100, and 3k Balco.	Basic/Advanced
TC.TYPE	Used to define the type of temperature compensation. Choices include Manual Nernstian, Automatic Nernstian, and Automatic Nernstian with Solution Coefficient.	Basic/Advanced
AO1.OUT	Used to set Analog Output One range.	Basic/Advanced
AO2.OUT	Used to set Analog Output Two range.	Basic/Advanced
RELAY1	Used to set Relay Output One function and parameters. Choices include Setpoint, Cycle Timer, Diagnostics, and Cleaner.	Basic/Advanced
RELAY2	Used to set Relay Output Two function and parameters. Choices include Setpoint, Cycle Timer, Diagnostics, and Cleaner.	Basic/Advanced
RELAY3	Used to set Relay Output Three function and parameters. Choices include Setpoint, Cycle Timer, Diagnostics, and Cleaner.	Basic/Advanced
DAMPNG	Used to reduce fluctuation in the display values and output signals.	Basic/Advanced
DIAGS	Used to set the sensor diagnostics ON or OFF.	Basic/Advanced
SAF.MD.1	Used to define the output signal state for Analog Output One when a detected error results in a condition that renders the analyzer inoperable. Choices include fail Low or fail High.	Basic/Advanced
SAF.MD.2	Used to define the output signal state for Analog Output Two when a detected error results in a condition that renders the analyzer inoperable. Choices include fail Low or fail High.	Basic/Advanced
SPIKE	Used to set the spike magnitude level.	Advanced

As with the other modes and states of operation, the NEXT Smart Key provides access to all Modify Configure States. Pressing the NEXT Smart Key sequentially moves the user through each state. This cycle repeats until a Modify Configure State is selected using the SELECT Smart Key or the escape function is chosen using the Exit To MEASURE Smart Key. Use Figure 8-2 and 8-3 to identify the Smart Key assignments and the resulting action.

When selecting a Modify Configure State, the configured (i.e., active) item within that state will be the first item shown. This item will remain the configured item until a new item is entered and the configuration saved.

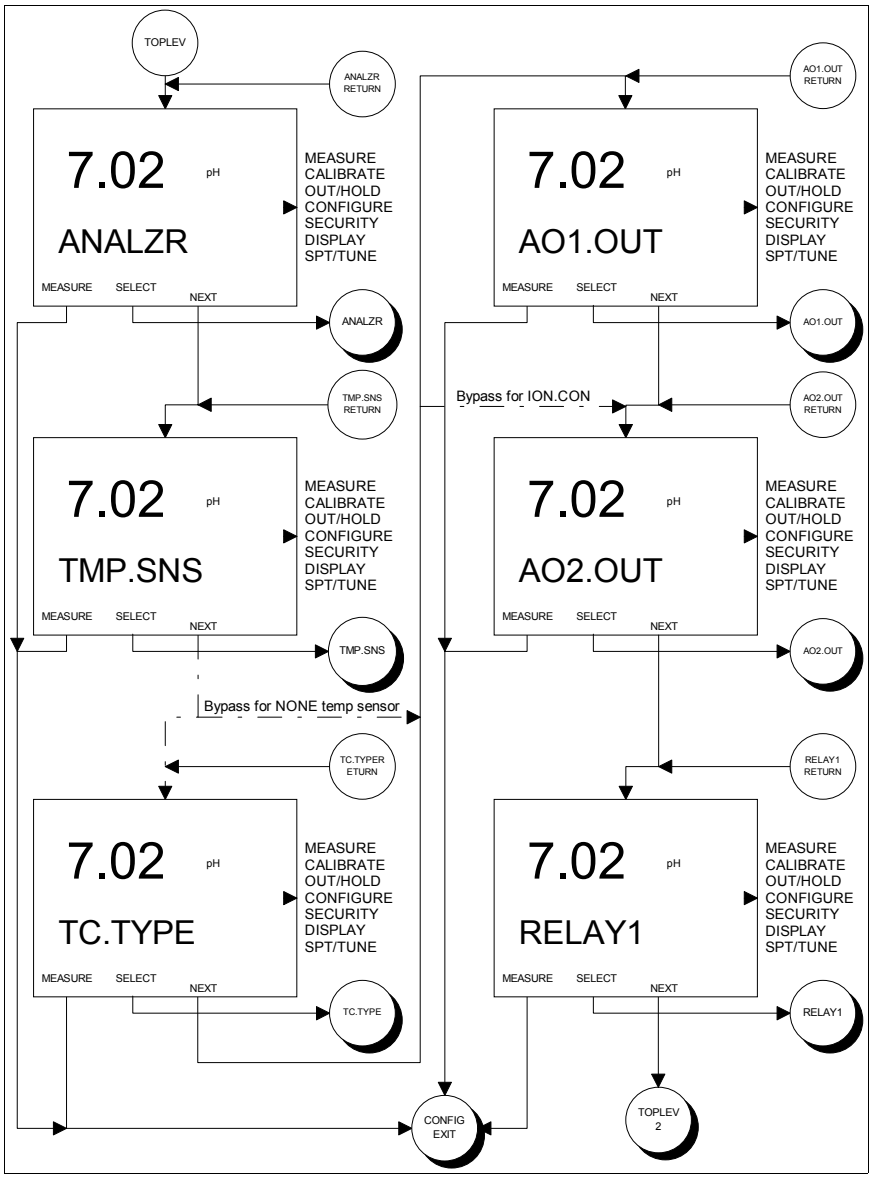


Figure 8-2. Screen Flow Diagram For Modify Configure States of Operation - Part One.

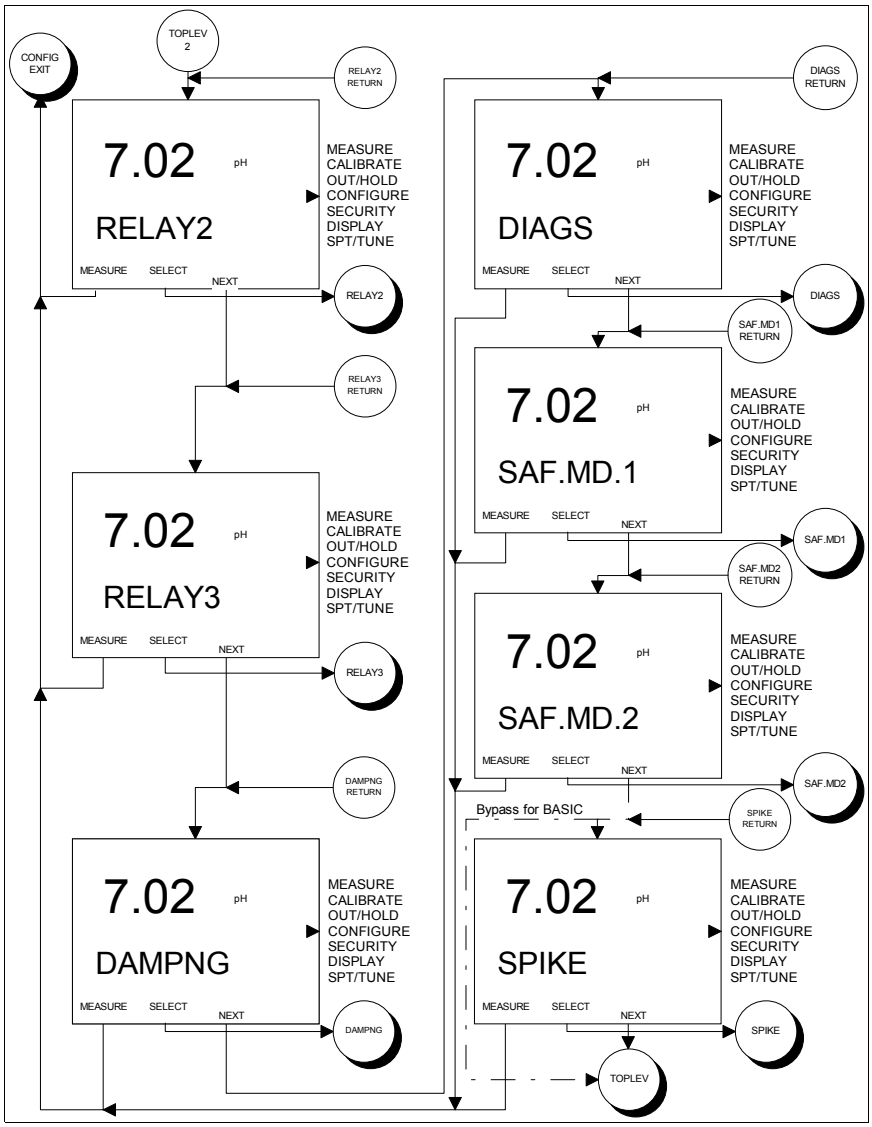


Figure 8-3. Screen Flow Diagram For Modify Configure States of Operation - Part Two.

The following subsections contain detailed descriptions of each Modify Configure State of Operation.

Analyzer State (Basic/Advanced)

The Analyzer State sets the type of measurement (i.e., process variable) and must coincide with the type of sensor being used. Table 8-2 describes the function and programming mode of each state.

Table 8-2. Analyzer States

State	Function	Programming Mode
PH	Used to measure the pH of a solution. Process variable engineering units are pH.	Basic/Advanced
ORP	Used to measure the Oxidation Reduction Potential (ORP) of a solution. Process variable engineering units are milliVolts (mV).	Basic/Advanced
PION	Used to measure the concentration of a specific ion in a solution. The sensor must use a measurement electrode specific to the ion of interest. Process variable engineering units are milliVolts (mV).	Basic/Advanced
ION.CON	Used to measure the concentration of a specific ion in a solution. The sensor must use a measurement electrode specific to the ion of interest. Process variable engineering units are set by the user, and the output is directly proportional to those units and is established by the number of concentration decades.	Advanced

pH Analyzer State (Basic/Advanced)

The pH Analyzer State contains three types of sensors: Glass, Antimony, and Custom. Table 8-3 describes the function and programming mode of each state.

Table 8-3. pH Analyzer States

State	Function	Programming Mode
PH.GLAS	Used when the associated sensor has a standard glass measuring electrode.	Basic/Advanced
ANTMNY	Used when the associated sensor has an antimony measuring electrode.	Basic/Advanced
CUSTOM	Used when the associated sensor has a measuring electrode with a unique isopotential point and asymmetric potential.	Advanced

For Advanced configurations using the PH.GLAS and ANTMNY Analyzer States, the REF Z (i.e., reference impedance) value can be manually set to a new value or left at the default value of 100 kohms. The REF Z is the reference electrode impedance value that will trigger a diagnostic condition. This value is set using

the ▲ Smart Key to increment and the ▶ Smart Key to move. The ENTER Smart Key accepts the new value. See Section 13, Diagnostics, for more information on diagnostic reporting.

The reference impedance of a new ABB sensor is typically 1 to 2 kohms as measured by the diagnostic circuit of the TB84PH Advantage Series analyzer. Performance of the reference electrode is typically unaffected up to 100 kohms (i.e., the default REF Z value). Adjustment to other resistance values up to 1000 kohms is allowed; however, acceptable performance of the sensor must be determined by the user and the resistance values accordantly adjusted.

For the CUSTOM State, the ISO.PT (i.e., Isopotential pH value) and ASY.POT (i.e., Asymmetric Potential value) must be entered using the ▲ Smart Key to increment the blinking digit, the ▶ Smart Key to move to the next digit, and the ENTER Smart Key to enter the new value. The REF Z value can also be adjusted and must be set as previously described.

ORP and pION States (Basic/Advanced)

The ORP or pION Analyzer States are set by pressing the ENTER Smart Key on the desired state when displayed using the NEXT Smart Key. For Advanced configurations, the ORP and pION States will require the user to enter the REF Z value. The REF Z (i.e., reference impedance) is the reference electrode impedance value that will trigger a diagnostic condition.

The REF Z value is set using the ▲ Smart Key to increment the blinking digit, the ▶ Smart Key to move to the next digit, and the ENTER Smart Key to enter the new value. See Section 13, Diagnostics, for more information on diagnostic reporting.

Ion Concentration State (Advanced)

The ION.CON (i.e., Ion Concentration) State allows for pION sensor inputs to be converted to concentration units such as ppb and ppm. This state uses temperature compensated mV values and applies a logarithmic function that has a fixed end point in millivolts, an ion valence ranging from -3 to +3, and an end point magnitude which can be set to 10, 100, or 1000.

The ION.CON State functions by associating an end millivolt value to an end magnitude value. The valence determines the millivolt change per decade of concentration and is defined by the Nernst Equation (i.e., 59.16 mV/decade for a valence equal to 1, 29.58 mV/decade for a valence equal to 2, and 19.72 mV/decade for a valence equal to 3). If the valence is negative the millivolt/concentration relationship will have a negative slope. The number of magnitudes defines the analyzer output. For example, two magnitudes would set the output to 0-10% for the first magnitude and 10-100% for the second magnitude.

Configure an ION.CON Analyzer State using Figure 8-4 as a reference and the following procedure:

1) Enter the ION.CON State using the ENTER Key.

2) Set the engineering UNIT by toggling to the desired unit using the NEXT Key and entering the unit using the ENTER Key.

3) Set the VALENC (i.e., valence) by incrementing or decrementing the displayed value using ▲ and ▼ Keys respectively, and entering the new value using the ENTER Key.

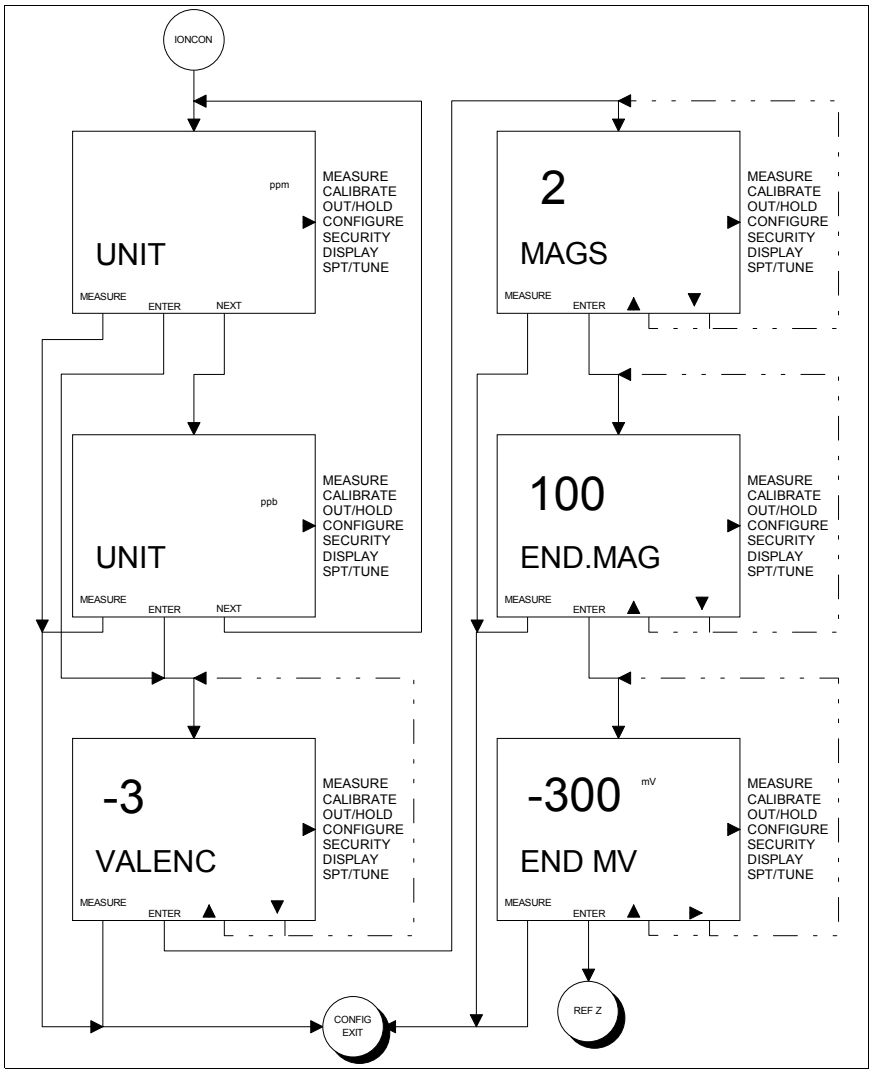


Figure 8-4. Screen Flows For Ion Concentration Configure State of Operation.

4) Set the MAGS (i.e., magnitudes) by incrementing or decrementing the displayed value using ▲ and ▼ Keys respectively, and entering the new value using the ENTER Key.

5) Set the END.MAG (i.e., ending magnitude) by incrementing or decrementing the displayed value using ▲ and ▼ Keys respectively, and entering the new value using the ENTER Key.

6) Set the END MV (i.e., ending millivolt) by using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit and pressing the ENTER Key

to enter the new value.

7) Set the REFZ (i.e., reference impedance) by using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit and pressing the ENTER Key to enter the new value.

Temperature Sensor State (Basic/Advanced)

The Temperature Sensor State configures the temperature input for a Pt100, 3 kohm Balco, or no (i.e., NONE) RTD.

Set the Temperature Sensor State using the following procedure.

1) Select the TMP.SNS State using the SELECT Key.

2) Choose the desired temperature sensor by using the NEXT Key to toggle between NONE, 3K.BLCO (i.e., 3 kohm Balco), and PT100, and enter the temperature sensor by using the ENTER Key when the correct sensor is displayed in the secondary display.

Temperature Compensation State (Basic/Advanced)

Temperature affects the process variable in two ways. The first effect (i.e., Nernstian Effect) causes the sensor output to increase with increasing temperature. In the case of a pH sensor, the increase is roughly 0.03 pH/pH Unit From 7pH/10°C. Since ABB pH sensors use Silver/Silver Chloride Measurement and Reference Half Cells, the isopotential point (i.e., the pH value that is unaffected by temperature) of these sensors is 7 pH.

The second temperature effect is on the actual chemistry of the solution. Since ion disassociation can be a function of temperature, ion properties such as pH, ORP, and pION are affected by changes in process temperature. These effects can be empirically determined and included in the temperature compensation process using the Automatic Nernstian with Solution Coefficient Temperature Compensation option.

The Temperature Compensation State sets the desired compensating method. The three states of temperature compensation include Manual Nernstian, Automatic Nernstian, and Automatic Nernstian with Solution Coefficient. Table 8-

4 describes the function and programming mode of each state.

Table 8-4. Temperature Compensation States

State	Function	Programming Mode
MANUAL	Used when a fixed temperature value can be applied instead of a measured value. The initial value is set at 25°C. Use the Temperature Calibrate State to change the fixed temperature value. Nernstian compensation is applied using the fixed temperature value.	Basic/Advanced
AUTO	Used when a measured temperature value is being provided by a temperature sensor. Nernstian compensation is applied using the measured value.	Basic/Advanced
AUT.SOL	Used when a measured temperature value is being provided by a temperature sensor. Nernstian compensation and a solution coefficient is applied using the measured value.	Advanced

Manual Nernstian State (Basic/Advanced)

Manual temperature compensation adjusts for temperature effects of the sensor at a specific temperature. A temperature sensor is not required (i.e., NONE for TMP.SNS). The Manual Nernstian State is only applicable for pH Analyzer States. The displayed process variable (i.e., pH) is standardized to 25°C.

When using the Manual Nernstian State, the process temperature will be automatically set to 25°C. To adjust the temperature to other values, use the Temperature Calibrate State and set the temperature to the new value as specified in Section 6, Calibrate Mode. The allowable solution temperature range is 0 to 140°C.

Set the Temperature Compensation State to Manual Nernstian State using the following procedure:

1) Select the TC.TYPE State using the Select Key.

2) Move to the MANUAL Nernstian State using the Next Key.

3) Set the TC.TYPE to MANUAL using the Enter Key.

Automatic Nernstian State (Basic/Advanced)

Automatic Nernstian temperature compensation requires an input from a temperature sensing device. The input can be either from a Pt100 or 3 kohm Balco RTD.

Automatic Nernstian temperature compensation corrects for temperature effects caused by sensor and is only applicable for the pH Analyzer State. The displayed process variable (i.e., pH) is standardized to 25°C, and the allowable solution temperature range is 0 to 140°C.

Set the Temperature Compensation State to Automatic Nernstian State using the following procedure:

1) Select the TC.TYPE State using the Select Key.

2) Move to the AUTO Nernstian State using the Next Key.

3) Set the TC.TYPE to AUTO using the Enter Key.

Automatic Nernstian With Solution Coefficient State (Advanced)

The Automatic Nernstian With Solution Coefficient State compensates the sensor output to a reference temperature of 25°C using the Nernst Equation and a solution

coefficient. The solution coefficient is entered as the change in pH Units/10°C for the pH Analyzer State and has the range of +/- 1.999 pH units/10°C, or the change in mV/10°C for ORP, pION, and ION.CON Analyzer States and has the range of +/- 19.99 mV/10°C.

This compensation method requires an input from a temperature sensing device. The input can be either from a Pt100 or 3 kohm Balco RTD, and the allowable solution temperature range is 0 to 140°C.

The standardized, displayed process variable complies with the following formula:

$$StandardAutopH \pm Sol.Coef. x \frac{Temp.°C - 25°C}{10°C}$$

CAUTION	**Automatic Nernstian With Solution Coefficient compensation can only be used for processes that are extremely repeatable.**

To use this type of compensation, a representative sample of the process must be taken, and the measured parameter (i.e., pH, ORP, or pION) must be determined using the TB84PH Advantage Series analyzer set to Automatic Nerstian compensation and a sensor with a temperature sensing device. A representative process sample must be measured at two different temperatures indicative of the range of process solution temperatures expected in the final installed location. The change in the process variable between the two temperatures must be divided by the temperature difference, and this quantity multiplied by 10. If the process variable decreased as temperature increased, the coefficient must be positive (+). Conversely, if the process variable increased as temperature increased, the coefficient must be negative (-).

Set the Temperature Compensation State to Automatic Nernstian With Solution Coefficient State using the following procedure:

1) Select the TC.TYPE State using the SELECT Key.

2) Move to the AUT.SOL (i.e., Automatic Nernstian With Solution Coefficient)

State using the NEXT Key.

3) Set the TC.TYPE to AUT.SOL using the ENTER Key.

4) Set the PH/10C or MV/10C value (as the case may be) using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit and pressing the ENTER Key to enter the new value.

Analog Output One State (Basic/Advanced)

The Analog Output One State sets the output span, range, and function. The output span is software selectable for either zero to 20 milliamperes or four to 20 milliamperes and is source to the Primary Process Variable. For Basic configurations, the output function can only be linear. Lower and upper range values must be entered and are defaulted to the full scale process variable range (e.g., 0-14 pH for pH Analyzer States). For Advanced configurations, the output function can be linear or non-linear. For a non-linear output, lower and upper range values must also be entered as well as five break points.

Linear Output State (Basic/Advanced)

The Linear Output State establishes the lower and upper range values. The default values for the output represent the full scale process variable range (e.g., 0-14 pH).

For a reverse acting output, reverse the zero or four and 20 milliampere values (e.g., 14 pH for the zero or four milliampere value and 0 pH for the 20 milliampere value).

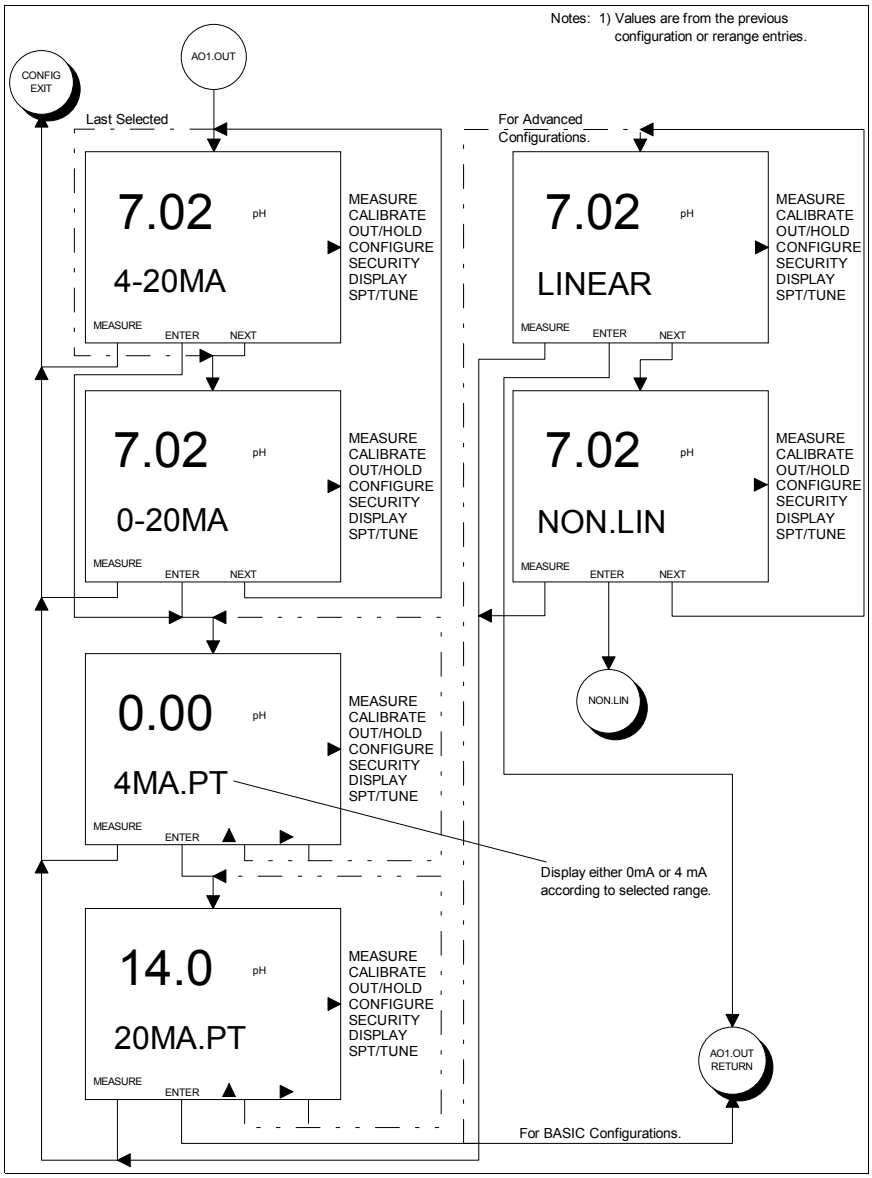


Figure 8-5. Screen Flow Diagram For Analog Output One Configure State of Operation.

Set the Linear Output State using Figure 8-5 as reference and the following procedure:

1) Select the AO1.OUT State using the SELECT Key.

2) Set the output span using the NEXT Key to toggle between 4-20MA and 0-20MA, and press the ENTER Key to enter the new span.

3) Set the process variable value for the 0 or 4 milliampere point using the ▲ Key

to increment the blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to enter the new value.

4) Set the process variable value for the 20 milliampere point using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to enter the new value.

5) Select the LINEAR Output State using the SELECT Key for Advanced configurations. For Basic configurations, this step will not be accessible.

Non-Linear Output State (Advanced)

The Non-Linear Output State sets the end point and break point values for a non-linear output function. The default values for the output represent the full scale process variable range (e.g.,0 to 14 or -1999 to +1999 mV) and the break points are set for a linear output (e.g., 20% input equals 20% output).

To define the break point values, a plot of the process variable against the desired output (or variable that represents the output value) must be segmented into six linear regions that best fit the non-linear relationship. The points where the linear regions intersect should fall on the non-linear function and represent the break points that are entered into Non-Linear Output State.

As with the Linear Output State, the output range must be defined and will represent the 0% input/0% output and 100% input/100% output points. Since the 0% and 100% points are defined by the output range, the break point information (e.g., X-1/Y-1, X-2/Y-2, etc. values) should not include the 0% input/0% output and 100% input/100% output values and must be entered as percentage of input range and output span. Also as with a linear output, a reverse acting non-linear output can be implemented by reversing the zero or four and 20 milliampere process variable and break point values (e.g., 1999 mV for the 4 milliampere value and -1999 mV for the 20 milliampere value).

Set the Analog Output One Non-Linear State using Figure 8-5 as a reference and the following procedure:

1) Select the AO2.OUT State using the SELECT Key.

2) Set the output span using the NEXT Key to toggle between 4-20MA and 0-20MA, and press the ENTER Key to enter the new span.

3) Set the process variable value for the zero or four milliampere point using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to enter the new value.

4) Set the process variable value for the 20 milliampere point using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to enter the new value.

4) Select the NON.LIN Output State by using the NEXT Key to change the programming state from LINEAR to NON.LIN and using the SELECT Key to accept the NON.LIN Output State.

5) Set the input percentage for the first break point (X-1) using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to enter the new value.

6) Set the output percentage for the first break point (Y-1) using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to enter the new value.

7) Repeat steps 5 and 6 for the remaining four break points.

Table 8-5. Non-linear Output Example Values

Break Point	ORP Signal (mV)	Output Range (mA)	Percent Input (%)	Percent Output (%)
	0	4.0	0	0
1	120	5.6	20	10
2	270	8.8	45	30
3	360	12.0	60	50
4	420	15.2	70	70
5	540	19.2	90	95
	600	20.0	100	100

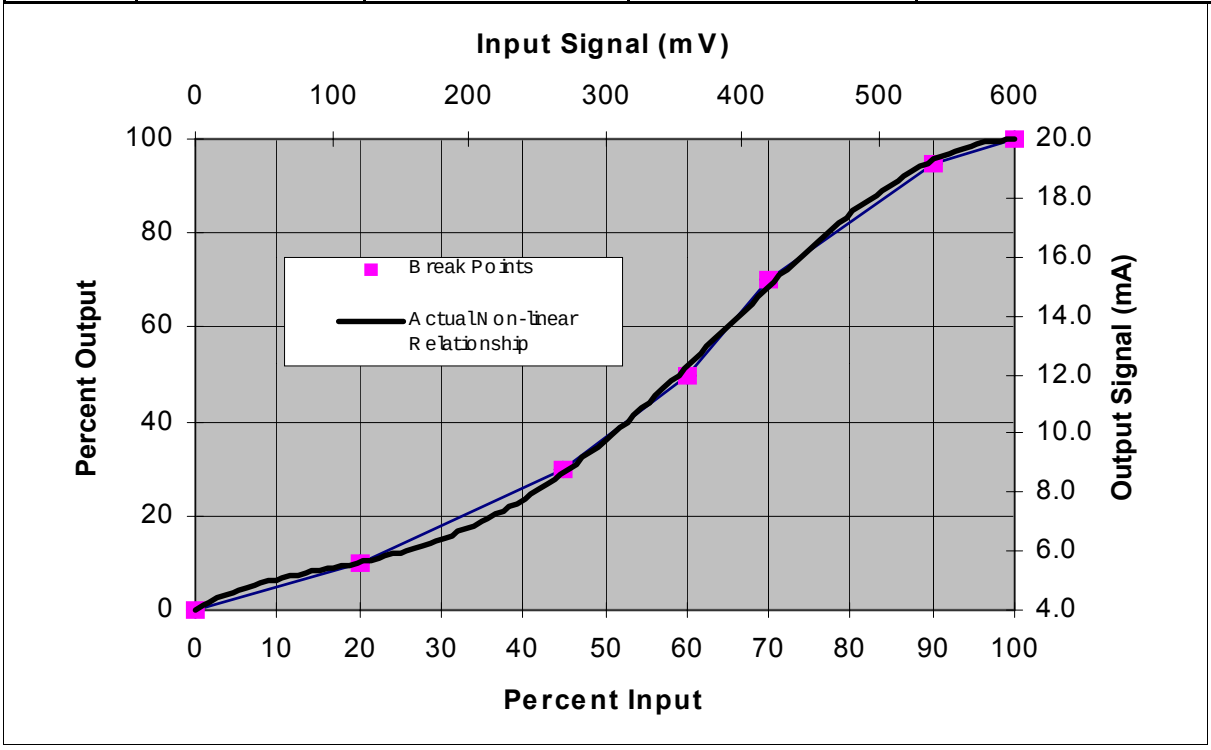


Figure 8-6. Non-linear Output Break Point Determination.

Table 8-5 and Figure 8-6 illustrate the use of the Non-linear Output function. This information is only for illustration purposes

and does not characterize any specific application.

Analog Output Two State (Basic/Advanced)

The Analog Output Two State sets the output source, span, and range. The output can be sourced to the Primary Process Variable or Temperature. As with Analog Output One, the output span is software selectable for either zero to 20 milliamperes or four to 20 milliamperes. The output function is always linear. Lower and upper range values must be entered and are defaulted to the full scale process variable range (e.g., 0-14 pH for pH Analyzer States).

Set the Analog Output Two State using Figure 8-7 as reference and the following procedure:

1) Select the AO2.OUT State using the SELECT Key.

2) Set the output source using the NEXT Key to toggle between PV and TEMP, and press the ENTER Key to enter the new source.

3) Set the output span using the NEXT Key to toggle between 4-20MA and 0-20MA, and press the ENTER Key to enter the new span.

4) Set the process variable value for the 0 or 4 milliampere point using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to enter the new value.

5) Set the process variable value for the 20 milliampere point using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to enter the new value.

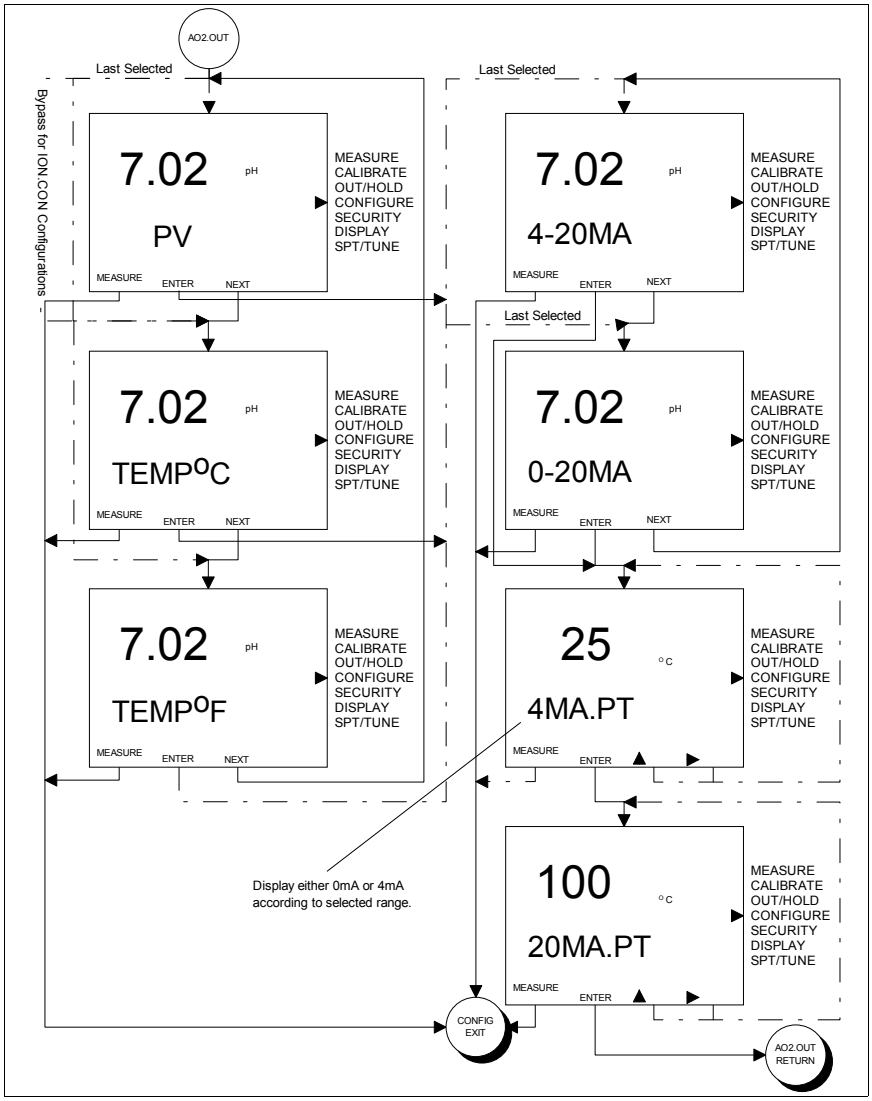


Figure 8-7. Screen Flow Diagram For Analog Output Two Configure State of Operation.

Relay Output One (Basic/Advanced)

The Relay Output One State sets the output function and related parameters for Relay Output One. The output function is dependent on the programming mode. For Basic configurations, Relay One output functions are limited to Setpoint control of the Process Variable. For Advanced configurations, the output functions are not limited and can be configured as a Setpoint sourced to the Process Variable or Temperature, Cycle Timer, Diagnostic, or Cleaner.

Set the output function of Relay Output One State using Figure 8-8 as reference and the

following procedure:

1) Select the RELAY1 State using the SELECT Key.

2) Set the output function using the NEXT Key to toggle between HI.PV and LO.PV for Basic Configurations or HI.PV, LO.PV, HI.TMP.C (i.e., High Temperature in Celsius), LO.TMP.C, HI.TMP.F (i.e., High Temperature in Fahrenheit), LO.TMP.F, DIAGS (i.e, Diagnostics), HI.PV.CT (i.e., High Process Variable Cycle Timer), LO.PV.CT, or CLNR (i.e., Cleaner), and press the ENTER Key to enter the new output function.

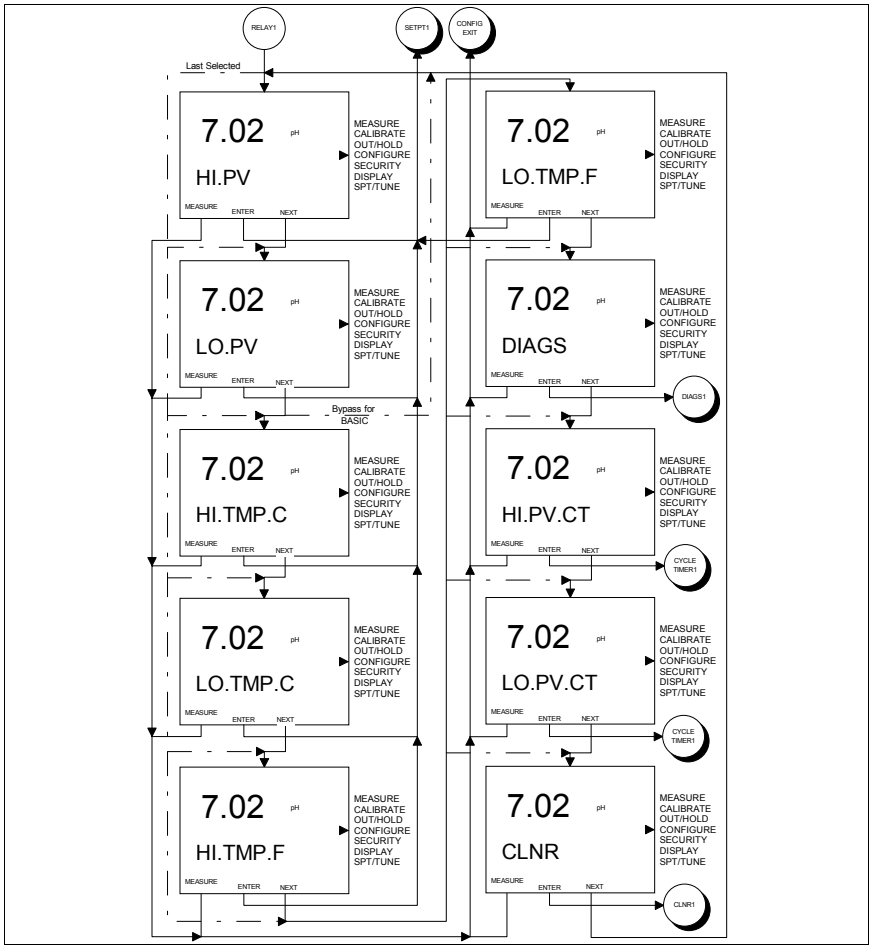


Figure 8-8. Screen Flow Diagram For Relay Output One Configure State of Operation.

Since the parameters for each type of relay function are the same, this information will be given after reviewing the applicable functions for each relay output.

Relay Output Two (Basic/Advanced)

The Relay Output Two State sets the output function and related parameters for Relay Output Two. The output function is dependent on the programming mode. For Basic configurations, Relay Two output functions are limited to Setpoint control of the Process Variable and Temperature. For Advanced configurations, the output functions are not limited and can be configured as a Setpoint sourced to the Process Variable or Temperature, Cycle Timer, Diagnostic, or Cleaner.

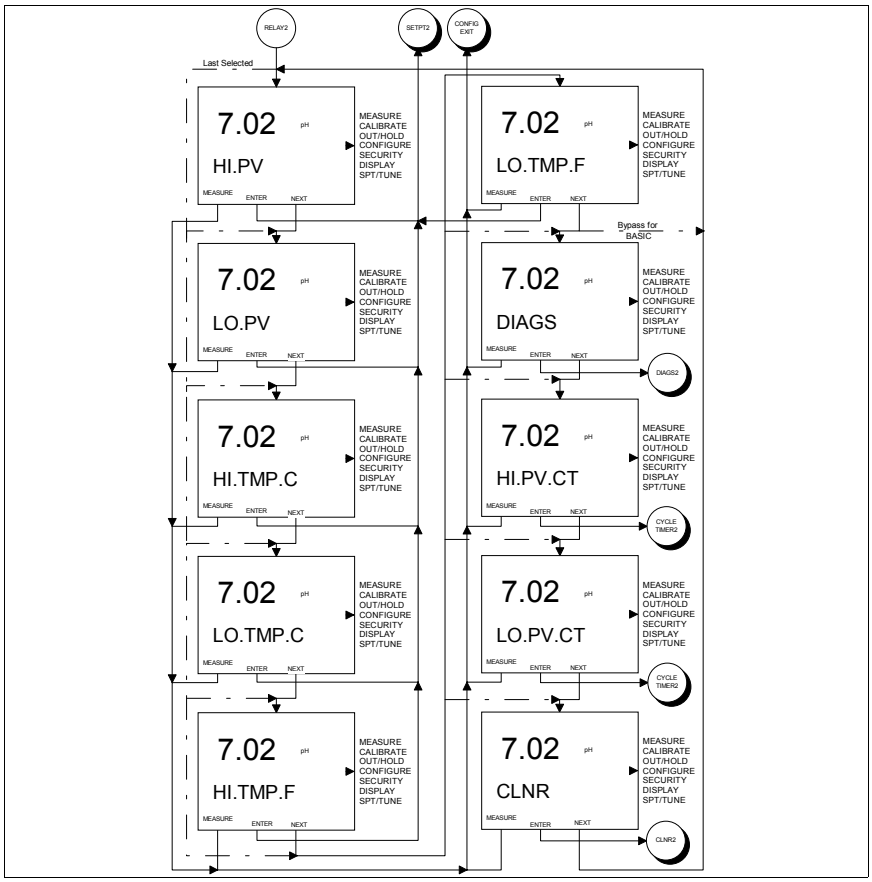


Figure 8-9. Screen Flow Diagram For Relay Output Two Configure State of Operation.

Set the output function of Relay Output Two State using Figure 8-9 as reference and the following procedure:

1) Select the RELAY2 State using the SELECT Key.

2) Set the output function using the NEXT Key to toggle between HI.PV, LO.PV,

HI.TMP.C, LO.TMP.C, HI.TMP.F, and LO.TMP.F for Basic Configurations or HI.PV, LO.PV, HI.TMP.C, LO.TMP.C, HI.TMP.F, LO.TMP.F, DIAGS, HI.PV.CT, LO.PV.CT, or CLNR, and press the ENTER Key to enter the new function.

Since the parameters for each type of relay function are the same, this information will be given after reviewing the applicable functions for each relay output.

Relay Output Three (Basic/Advanced)

The Relay Output Three State sets the output function and parameters for Relay Output Three. The output function is dependent on the programming mode. For Basic configurations, Relay Three output functions are limited to Setpoint control of the Process Variable and Temperature and Diagnostic notification. For Advanced configurations, the output functions are not limited and can be configured as a Setpoint sourced to the Process Variable or Temperature, Cycle Timer, Diagnostic, or Cleaner.

Set the output function of Relay Output Three State using Figure 8-10 as reference and the following procedure:

1) Select the RELAY3 State using the SELECT Key.

2) Set the output function using the NEXT Key to toggle between HI.PV, LO.PV, HI.TMP.C, LO.TMP.C, HI.TMP.F, LO.TMP.F, and DIAGS for Basic Configurations or HI.PV, LO.PV, HI.TMP.C, LO.TMP.C, HI.TMP.F, LO.TMP.F, DIAGS, HI.PV.CT, LO.PV.CT, or CLNR, and press the ENTER Key to enter the new function.

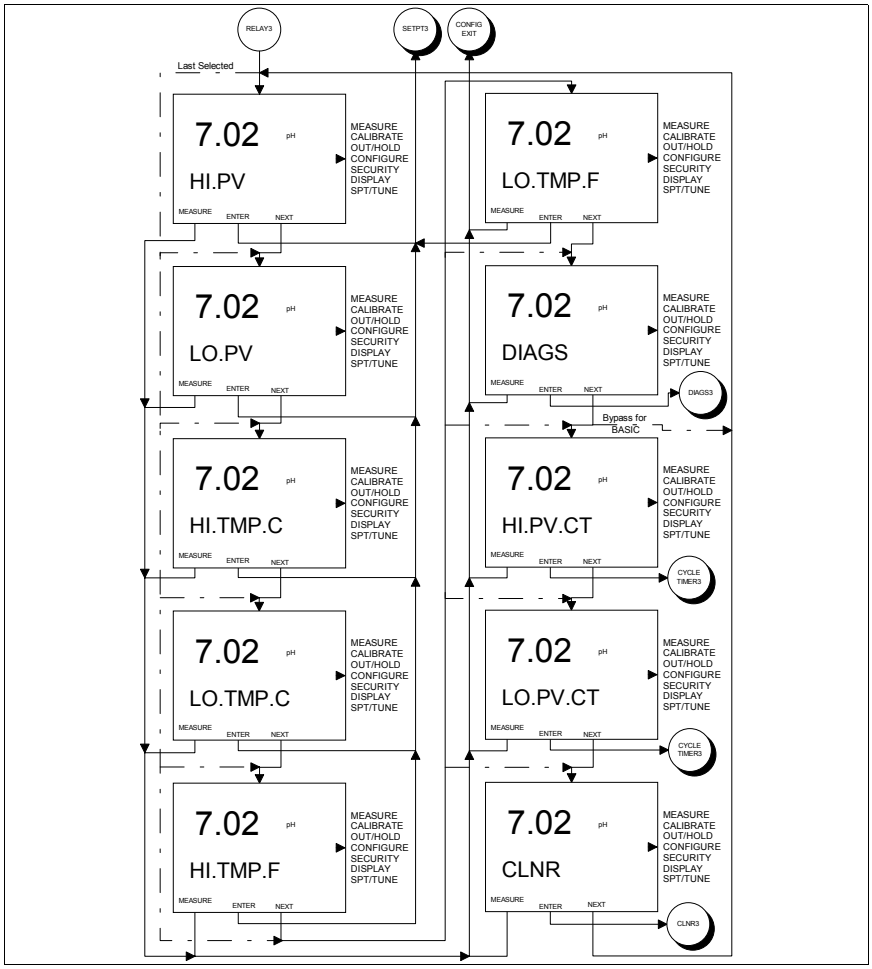


Figure 8-10. Screen Flow Diagram For Relay Output Three Configure State of Operation.

Since the parameters for each type of relay function are the same, this information will be given after reviewing the applicable functions for each relay output.

Setpoint Relay Output (Basic/Advanced)

A Setpoint Relay Output can be configured to energize when the Process Variable or Temperature exceeds (i.e., a High Setpoint) or falls below (i.e., a Low Setpoint) a defined level. Valid Setpoint values are limited to the Process Variable and/or Temperature range of the TB84PH Advantage Series analyzer. See Table 1-3, Specifications, for analyzer range values.

To prevent relay chatter, a Setpoint Relay Output has an configurable Deadband. The Deadband control keeps the relay energized until the Process Variable or Temperature has decreased below a High Setpoint value or above a Low Setpoint value by the Deadband value. Valid Deadband values are 0.00 to 10.00 pH for pH, 0 to 200 mV for ORP and pION, 0 to 10% of the END.MAG (i.e., End Magnitude) for Ion Concentration Process Variable sources and 0 to 10°C (18°F) for Temperature sources.

A Time Delay control also refines the function of a Setpoint Relay. Entering a Time Delay value greater than 0.0 minutes enables a waiting period before energizing the relay once the setpoint condition has been met. Valid Time Delay values are 0.0 to 99.9 minutes.

Set the Setpoint parameters of a Relay Output using Figure 8-11 as reference and the following procedure:

1) Set the Setpoint (i.e., LO SPT or HI SPT) using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to enter the new value.

2) Set the Deadband (i.e., DBAND) using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit and, press the ENTER Key to enter the new value.

3) Set the Time Delay in minutes (i.e., DLY.MIN) using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to enter the new value.

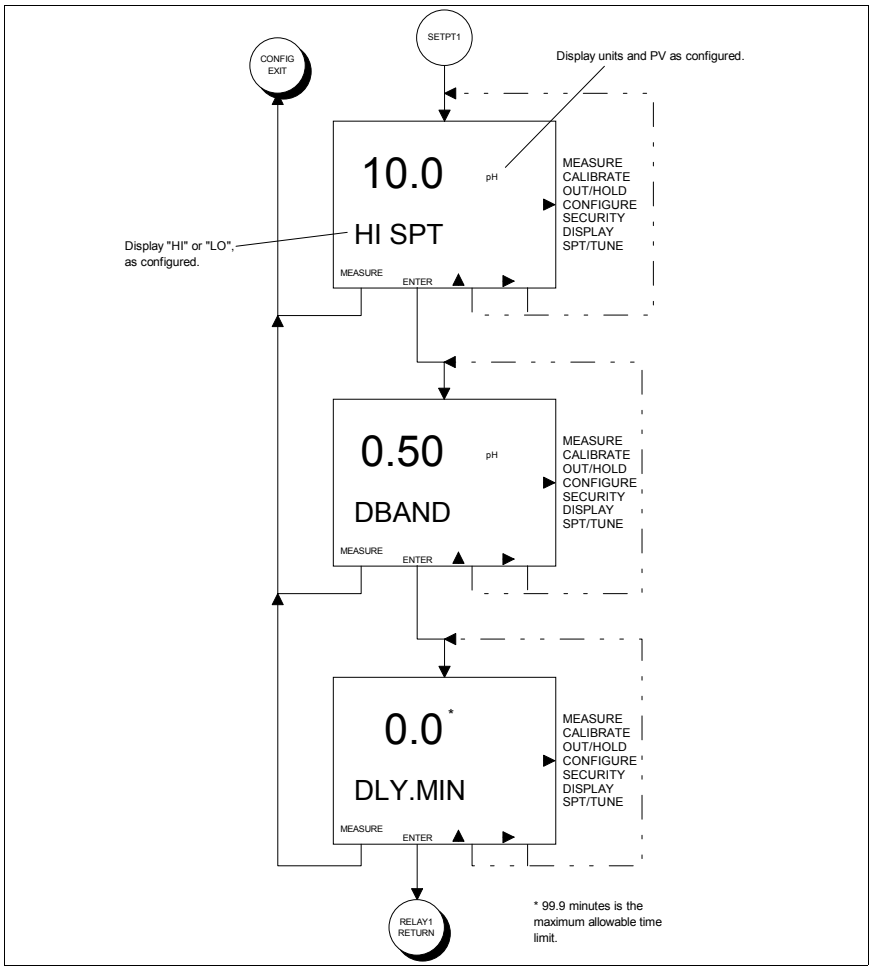


Figure 8-11. Screen Flow Diagram For Setting the Setpoint Relay Output Configure State of Operation.

Diagnostic Relay Output (Basic/Advanced)

A Diagnostic Relay Output simply energizes when a diagnostic condition has be detected. The relay can be configured to trigger on a sensor, instrument, or all diagnostic conditions.

Set the trigger for the Diagnostic Relay Output using Figure 8-12 as reference and the following procedure:

1) Set the Diagnostic trigger using the NEXT Key to toggle between ALL, SENSOR, and INSTR. (i.e., Instrument), and press the ENTER Key to enter the new trigger.

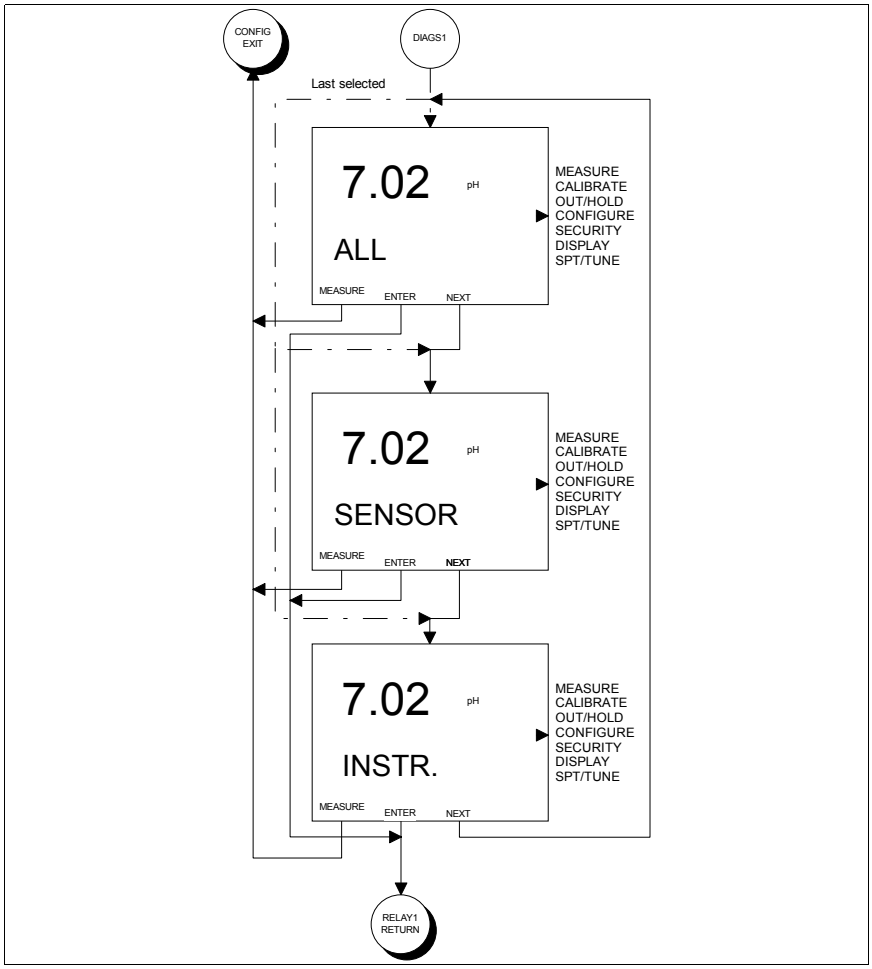


Figure 8-12. Screen Flow Diagram For Setting the Diagnostic Relay Output Configure State of Operation.

Cycle Timer Relay Output (Advanced)

A Cycle Timer can only be sourced to the Process Variable and can energize the relay for either a High or Low setpoint condition.

As with a Setpoint Relay Output, the Setpoint condition functions in the same manner; however, the Deadband control is replaced with

the Cycle Time. Thus, a Cycle Timer will energize the Relay Output for a set amount of time (ON.TIME) and de-energize for the remainder of the cycle (CYC.MIN). This cycle repeats until the Setpoint condition is no longer met. For more information on the Cycle Timer, see Section 2, Overview.

Valid Setpoint values are limited to the Process Variable range of the TB84PH Advantage Series analyzer. See Table 1-3, Specifications, for analyzer range values. Valid Cycle Time and On Time values are 0.0 to 99.9 minutes.

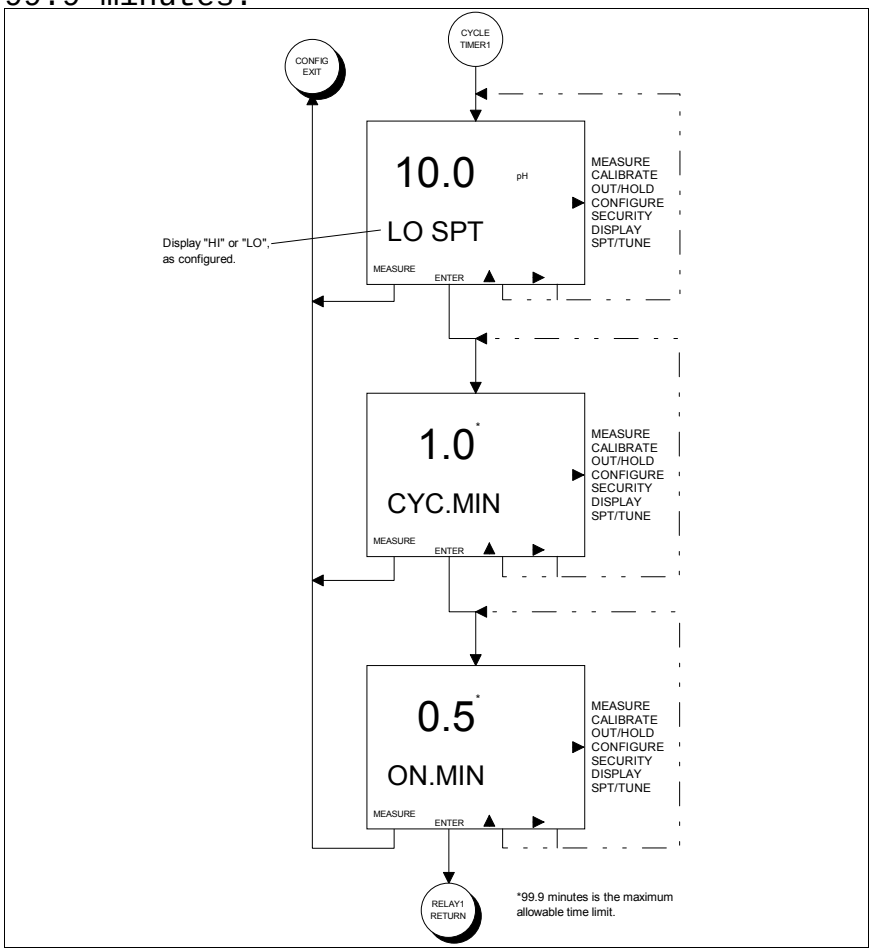


Figure 8-13. Screen Flow Diagram For Setting the Cycle Timer Relay Output Configure State of Operation

Set the Cycle Timer parameters of a Relay Output using Figure 8-13 as reference and the following procedure:

1) Set the Setpoint (i.e., LO SPT or HI SPT) using the ▲ Key to increment the blinking digit and the ▶ Key to move to

the next digit, and press the ENTER Key to enter the new value.

2) Set the Cycle Time in minutes (i.e., CYC.MIN) using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to enter the new value.

3) Set the On Time in minutes (i.e., ON.MIN) using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to enter the new value.

Cleaner Relay Output (Advanced)

Automatic sensor cleaning can be accomplished using any one of the three relay outputs. At a prescribed time interval, a Cleaner Relay Output will energize and allow the activation of a cleaning device. While in the energized state, analog and relay outputs can be held to values captured just prior to the cleaning cycle (i.e., energized state). If a relay hold condition is not feasible, non-cleaner relay outputs can be disable during a cleaning cycle.

To specify a cleaning cycle, the Cycle, On, and Recovery Times must be defined. The Cycle Time defines the repeating period between cleaning cycles, the On Time defines the length of time the relay will be energized, and the Recovery Time defines the length of time after the relay has been de-energized before the hold and/or disable condition(s) will be removed. Valid times for Cycle Time are 0.0 to 99.9 hours and for On and Recovery Times are 0.0 to 99.9 minutes.

Set the Cleaner parameters of a Relay Output using Figure 8-14 as reference and the following procedure:

1) Set the Cycle Time in hours (i.e., CYC.HRS) using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to enter the new value.

2) Set the On Time in minutes (i.e., ON.MIN) using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to enter the new value.

3) Set the Recovery Time in minutes (i.e., RCV.MIN) using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to enter the new value.

4) Hold the Analog Outputs (i.e., AO.HLD) during the On and Recovery Times using the YES Key, or leave the Analog Outputs live during the On and Recovery Times using the No Key.

5) Hold the Relay Outputs (i.e., RO.HLD) during the On and Recovery Times using the YES Key, or continue onto the Disable Relay Outputs State during the On and Recovery Times using the No Key.

6) Disable the Relay Outputs (i.e., RO.HLD) during the On and Recovery Times using the YES Key, or leave the Relay Outputs live during the On and Recovery Times using the No Key.

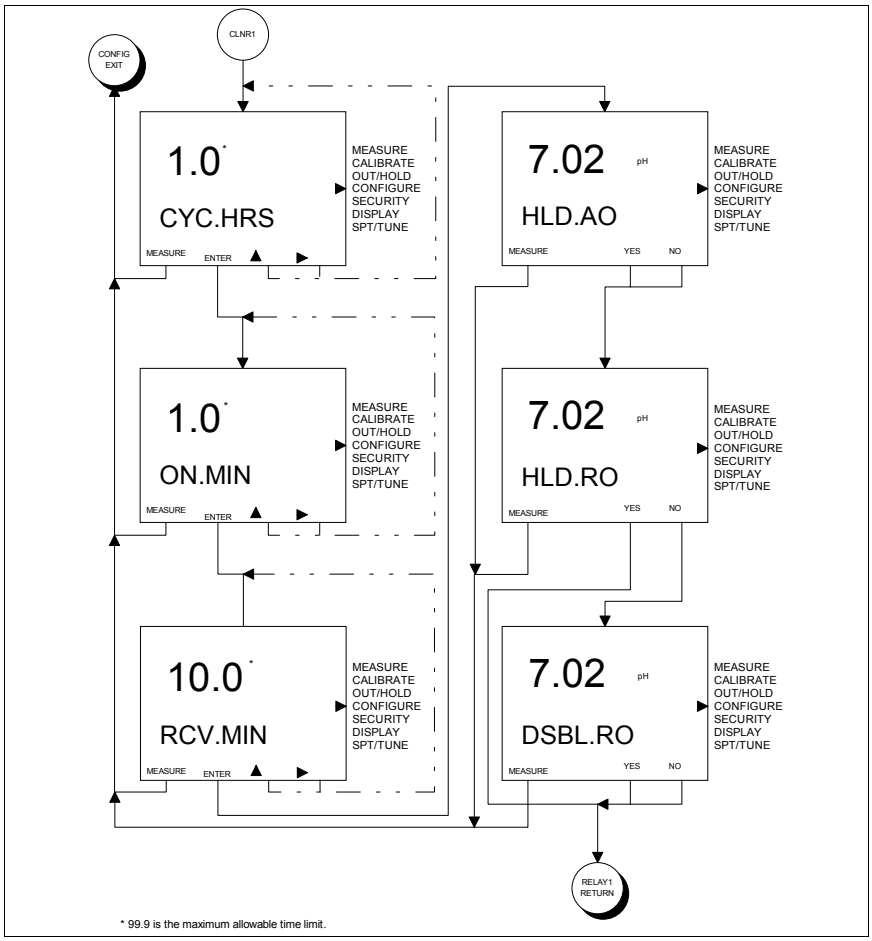


Figure 8-14. Screen Flow Diagram For Setting the Cleaner Relay Output Configure State of Operation

Damping State (Basic/Advanced)

The Damping State applies a lag function on the configured signals and reduces fluctuations caused by erratic process conditions. The damping value can be set from 0.0 to 99.9 seconds and represents the time required to reach 63.2% of a step change in the process variable.

For the Basic Programming Mode, the damping value can only be applied to the process variable input signal. The Advanced Programming Mode allows for separate damping of the Display Process Variable, Analog Output One, and Analog Output Two.

Set the Damping State using Figure 8-15 as a reference and the following procedure:

1) Select the DAMPNG State using the SELECT Key.

2) For Basic configurations, set the new damping value using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to enter the new value.

3) For Advanced configurations, set the new damping value for the Displayed Process Variable (i.e., DSP.SEC) using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to enter the new value.

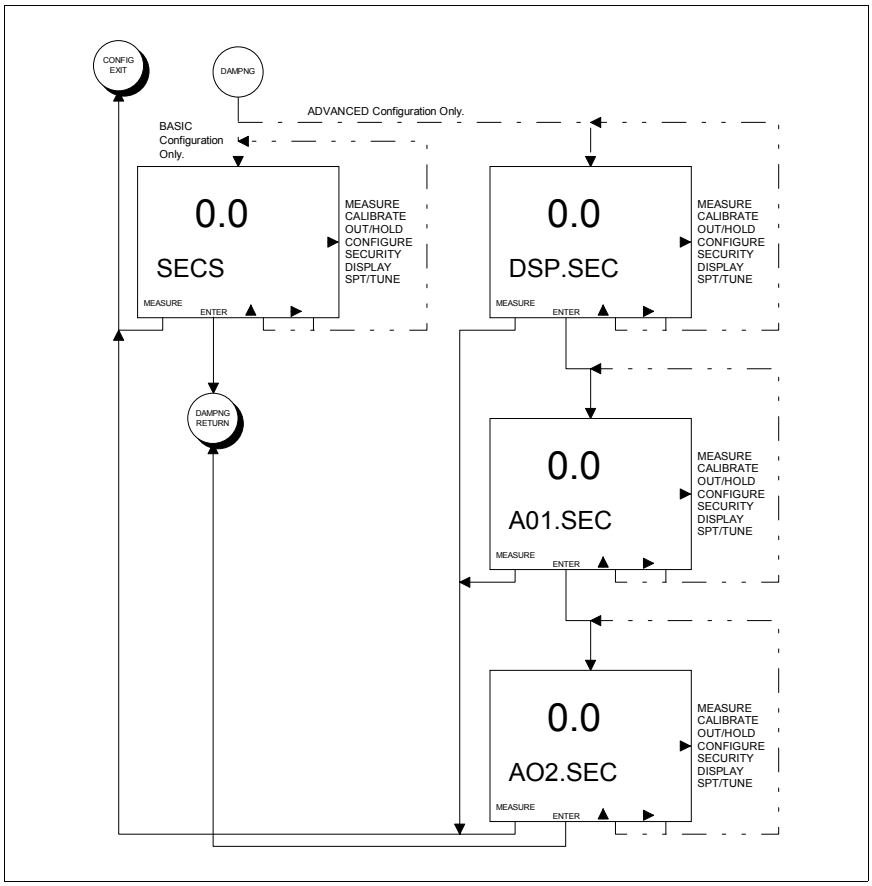


Figure 8-15. Screen Flow Diagram For Damping Configure State of Operation.

4) For Advanced configurations, set the new damping value for Analog Output One (i.e., AO1.SEC) using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to enter the new value.

5) For Advanced configurations, set the new damping value for Analog Output Two

(i.e., AO2.SEC) using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to enter the new value.

Diagnostics State (Basic/Advanced)

The Diagnostics State allows the built-in sensor diagnostics to be disabled. When a sensor does not have a solution ground such as Non-Advantage (i.e., TB5) sensors, the diagnostic signal cannot be injected into process liquid. For these situations and applications that use very pure water, the sensor diagnostics should be disabled.

Set the DIAG (i.e., Diagnostics) State using the following procedure:

1) Select the DIAG State using the SELECT Key.

2) Toggle the diagnostics function to the desired state (i.e., OFF or ON) using the ▲ Key, and press the ENTER Key to enter the new value.

Safe Mode One State (Basic/Advanced)

The Safe Mode One State determines the Analog Output One level if an error condition occurs that renders the analyzer inoperable. The available states are FAIL.LO (i.e., fail low) or FAIL.HI (i.e., fail high). For more information on error conditions, see Section 13, Diagnostics.

Set the Safe Mode One State using the following procedure:

1) Select the SAF.MD.1 State using the SELECT Key.

2) Set the safe mode by using the NEXT Key to toggle between FAIL.LO and FAIL.HI, and use the ENTER Key to enter the new value.

Safe Mode Two State (Basic/Advanced)

The Safe Mode Two State determines the Analog Output Two level if an error condition occurs that renders the analyzer inoperable. The available states are FAIL.LO (i.e., fail low) and FAIL.HI (i.e., fail high). For more information on error conditions, see Section

13, Diagnostics.

Set the Safe Mode Two State using the following procedure:

1) Select the SAF.MD.2 State using the SELECT Key.

2) Set the safe mode by using the NEXT Key to toggle between FAIL.LO and FAIL.HI, and use the ENTER Key to enter the new value.

Spike State (Advanced)

The Spike State sets the diagnostic spike level as a percent of output. This level will determine the magnitude of the spike.

When the Spike has been set for any level greater than 0% and is enabled in the Spike Output State, the TB84PH Advantage Series analyzer will modulate the Analog Output One signal by the configured level for one second out of every six seconds when a problem condition is detected. Using this modulation, the analyzer informs the operator of a detected diagnostic condition. For more information on problem conditions, see Section 13, Diagnostics. For a description of the diagnostic spike feature, see Section 2, Analyzer Functionality And Operator Interface Controls.

Set the Spike State using the following procedure:

1) Select the SPIKE State using the SELECT Key.

2) Set the SPK.MAG (i.e., spike magnitude) using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to enter the new value. The Spike Magnitude is entered as a percentage of the 16 milliampere output range for a four to 20 milliampere output or 20 milliampere output range for a zero to 20 milliampere output (e.g., 10% will generate a 1.6 milliampere spike for a four to 20 milliampere output range).

Note: Once the Spike State is OFF, changing the configured spike level in the Configure Mode will not reenable the Spike State. The Spike State can only be turned ON or OFF in the

CONFIGURATION LOCKOUT

The TB84PH Advantage Series analyzer has a lockout feature that, once engaged, prohibits access to the Configure Mode. This feature does not affect parameters that can be changed in the other modes of operation including Calibrate, Output/Hold, Security, secondary Display, and Setpoint/Tune.

To enable the lockout feature, change jumper W1 on the Microprocessor/Display PCB from pins 1 and 2 (i.e., position A - the factory default position) to pins 2 and 3 (i.e., position B). Use Figure 8-16 and Section 16, Replacement Procedures, for jumper positions and circuit board handling procedures.

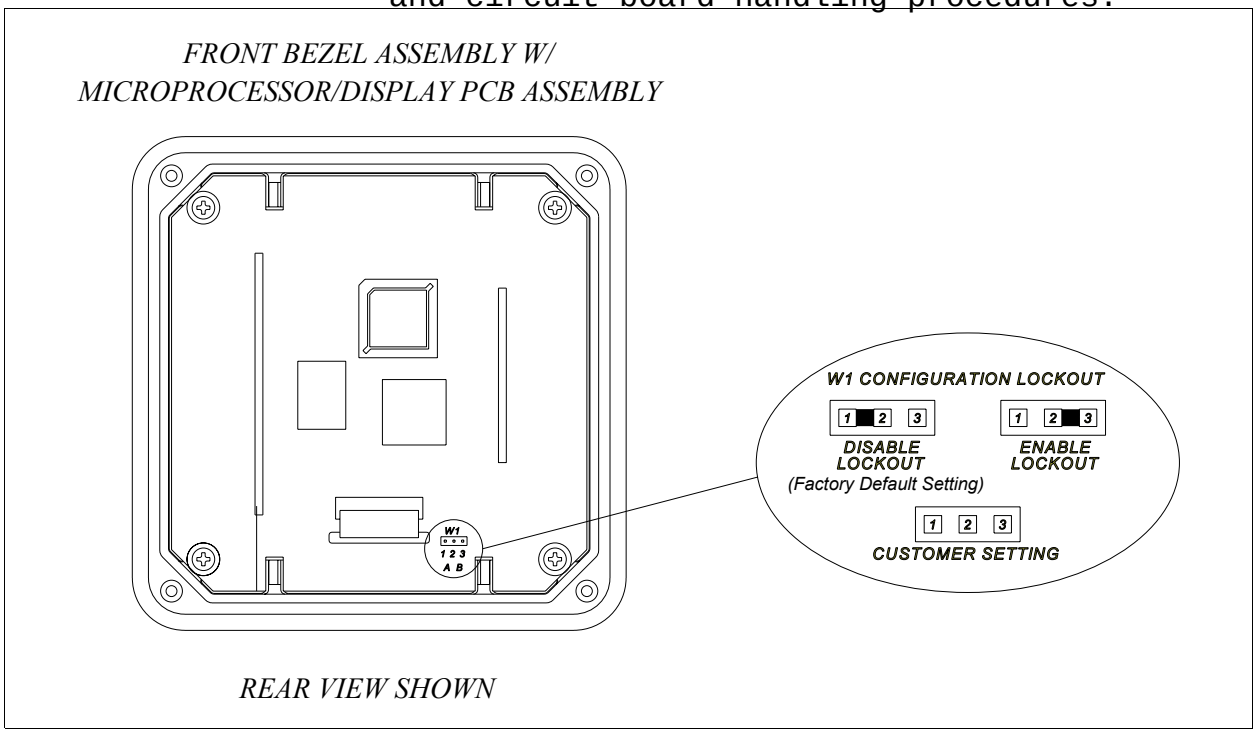


Figure 8-16. Configuration Lockout Jumper Location On Microprocessor/Display PCB Assembly.

SECTION 9 - SECURITY MODE

INTRODUCTION

The Security Mode of Operation establishes password protection against unauthorized changes to analyzer functions by unqualified personnel. Password protection can be assigned to the Calibrate, Output/Hold, Setpoint/Tune and Configure Modes of Operation.

SECURITY STATE OF OPERATION

The Security Mode of Operation provides password protection of critical operating environments. Each mode or state of operation that can be password protected is set by toggling the primary display between security OFF and ON using the ▲ Smart Key. As seen in Figure 9-1, all security assignments must be made before a password can be defined.

When one or more mode(s)/state has the security ON, the Security State will also be secured. One password assignment applies to all secured modes and states.

Set the Security State using Figure 9-1 as a reference and the following procedure:

1) Select the SECUR (i.e., Security) Mode of Operation using the SELECT Key.

2) Set the security for the CALIBR (i.e., Calibrate) Mode using the ▲ Key to toggle between ON and OFF, and press the ENTER Key to enter the new value.

3) Set the security for the OUTPUT (i.e., Output/Hold) Mode using the ▲ Key to toggle between ON and OFF, and press the ENTER Key to enter the new value.

4) Set the security for the CONFIG (i.e., Modify Configure) State using the ▲ Key to toggle between ON and OFF, and press the ENTER Key to enter the new value.

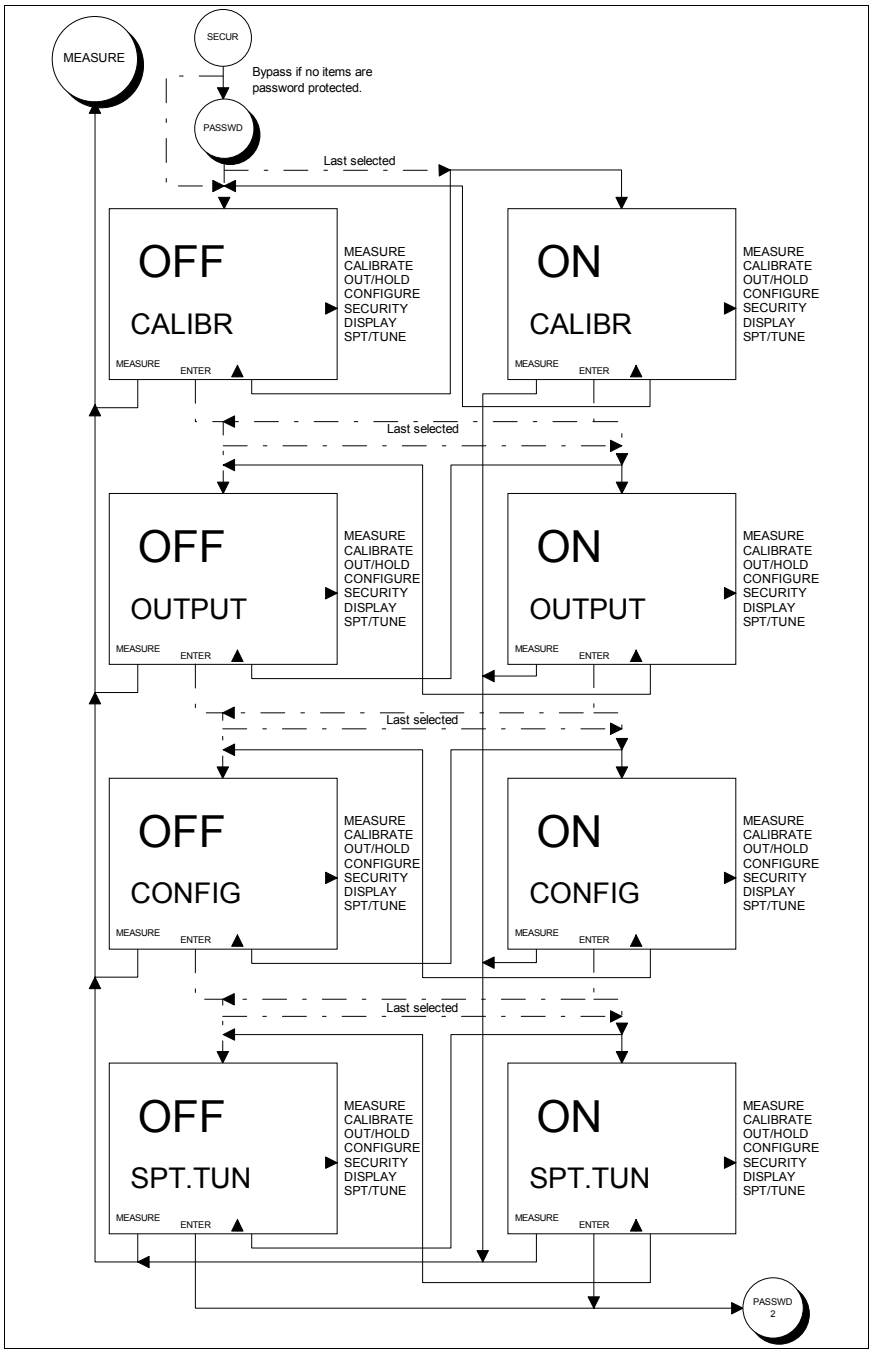


Figure 9-1. Screen Flow Diagram For Security State of Operation.

5) Set the security for the SPT.TUN (i.e., Setpoint/Tune) Mode using the ▲ Key to toggle between ON and OFF, and press the ENTER Key to enter the new value.

6) Define the password for all secured modes and states using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to enter the password.

Note: The password must be defined as three digits and verified to enable security on the modes/states entered in steps 2 through 4. If security is not ON for any of the modes/states, the password state will be bypassed.

6) Verify the password using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to enter the password.

Remove all security using the following procedure:

1) Select the SECUR Mode of Operation using the SELECT Key.

2) Enter the password for all secured modes and states using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to submit the password.

3) Set the security for the CALIBR (i.e., Calibrate) Mode by pressing the ▲ Key to toggle the display to OFF, and press the ENTER Key to enter the value.

4) Set the security for the OUTPUT (i.e., Output/Hold) Mode by pressing the ▲ Key to toggle the display to OFF, and press the ENTER Key to enter the value.

5) Set the security for the CONFIG (i.e., Modify Configure) State by pressing the ▲ Key to toggle the display to OFF, and press the ENTER Key to enter the value.

6) Set the security for the SPT.TUN (i.e., Setpoint/Tune) Mode by pressing the ▲ Key to toggle the display to OFF, and press the ENTER Key to enter the value.

Change the password or security state using the following procedure:

1) Select the SECUR Mode of Operation using the SELECT Key.

2) Enter the password for all secured modes and states using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to submit the password.

3) Leave the security state unchanged for CALIBR (i.e., Calibrate) Mode by using the ENTER Key Set, or if needed, change the security state for CALIBR (i.e., Calibrate) using the ▲ Key. Press the ENTER Key to enter the new value.

4) Leave the security state unchanged for OUTPUT (i.e., Output/Hold) Mode by using the ENTER Key Set, or if needed, change the security state for OUTPUT using the ▲ Key. Press the ENTER Key to enter the new value.

5) Leave the security state unchanged for CONFIG (i.e., Modify Configure) State by using the ENTER Key Set, or if needed, change the security state for CONFIG (i.e., Modify Configure) using the ▲ Key. Press the ENTER Key to enter the new value.

6) Leave the security state unchanged for SPT.TUN (i.e., Setpoint/Tune) Mode by using the ENTER Key Set, or if needed, change the security state for SPT.TUN (i.e., Setpoint/Tune) using the ▲ Key. Press the ENTER Key to enter the new value.

7) Change the password for all secured modes and states using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to enter the password.

8) Verify the new password using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to enter the password.

Note: If the password was not changed, the verification of the old password will not be required.

If the password is lost, the security can be removed using the Reset Password State of Operation. To reset the password, see Section 11, Utility Mode.

SECTION 10 - SECONDARY DISPLAY MODE

INTRODUCTION

The TB84PH Advantage Series analyzer has two display regions. In the Measure Mode of Operation, the primary display region shows the measured process variable, and the secondary display region can show a multitude of process, sensor, or analyzer information. This information can be viewed or set as the displayed value when in the Measure Mode of Operation.

SECONDARY DISPLAY STATE OF OPERATION

The Secondary Display Mode of Operation contains seven states of operation that provide information on the process temperature, output current values, sensor output, software revision, and spike status. As seen in Figure 10-1, each Secondary Display State can be sequentially viewed by using the NEXT Smart Key. To have any given Secondary Display State be continually shown in the Measure Mode, press the ENTER Smart Key while the desired state is displayed. The TB84PH Advantage Series analyzer will proceed to the Measure Mode and display the entered Secondary Display State in the secondary display region.

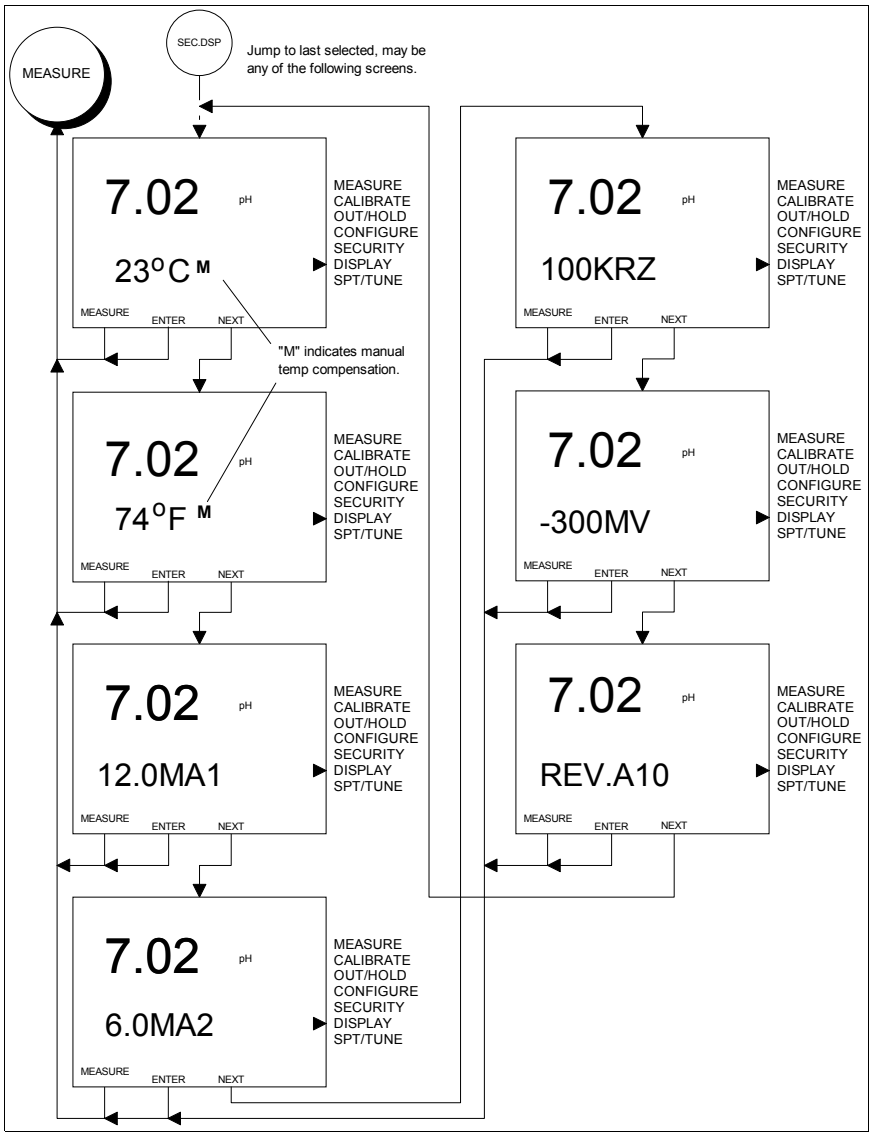


Figure 10-1. Screen Flow Diagram For Secondary Display States of Operation.

SECTION 11 - SETPOINT/TUNE MODE

INTRODUCTION

The Setpoint/Tune Mode of Operation provides a direct method to tune relay output parameters. Though this mode of operation can not be used to change the function a relay, it does provide the ability to change relay parameters pertinent to process control. To change the relay output function, see Section 8, Configure Mode.

SETPOINT/TUNE STATES OF OPERATION

The Setpoint/Tune Mode consists of three states of operation: RELAY1, RELAY2, and RELAY3. Each state provides the ability to update operational parameters for the configured relay functions. For instead if Relay Output One is configured to function as a High Process Variable Setpoint, the Setpoint, Deadband, and Time Delay will be tunable parameters available in the Setpoint/Tune Relay One State of Operation.

Since the tunable parameters are dependent on the configured relay function, the following sections will only describe the adjustment of these parameters.

Setpoint Relay Output (Basic/Advanced)

A Setpoint Relay Output can be configured to energize when the Process Variable or Temperature exceeds (i.e., a High Setpoint) or falls below (i.e., a Low Setpoint) a defined level. Valid Setpoint values are limited to the Process Variable and/or Temperature range of the TB84PH Advantage Series analyzer. See Table 1-3, Specifications, for analyzer range values.

To prevent relay chatter, a Setpoint Relay Output has an configurable Deadband. The Deadband control keeps the relay energized until the Process Variable or Temperature has decreased below a High Setpoint value or above a Low Setpoint value by the Deadband value. Valid Deadband values are 0.00 to 10.00 pH for pH, 0 to 200 mV for ORP and pION, 0 to 10% of the END.MAG (i.e., End Magnitude) for Ion Concentration Process Variable sources and 0 to 10°C (18°F) for Temperature sources.

A Time Delay control also refines the function of a Setpoint Relay. Entering a Time Delay value greater than 0.0 minutes enables a waiting period before energizing the relay once the setpoint condition has been met. Valid Time Delay values are 0.0 to 99.9 minutes.

Set the Setpoint parameters of a Relay Output using Figure 8-11 as a reference and the following procedure:

1) Set the Setpoint (i.e., LO SPT or HI SPT) using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to enter the new value.

2) Set the Deadband (i.e., DBAND) using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit and, press the ENTER Key to enter the new value.

3) Set the Time Delay in minutes (i.e., DLY.MIN) using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to enter the new value.

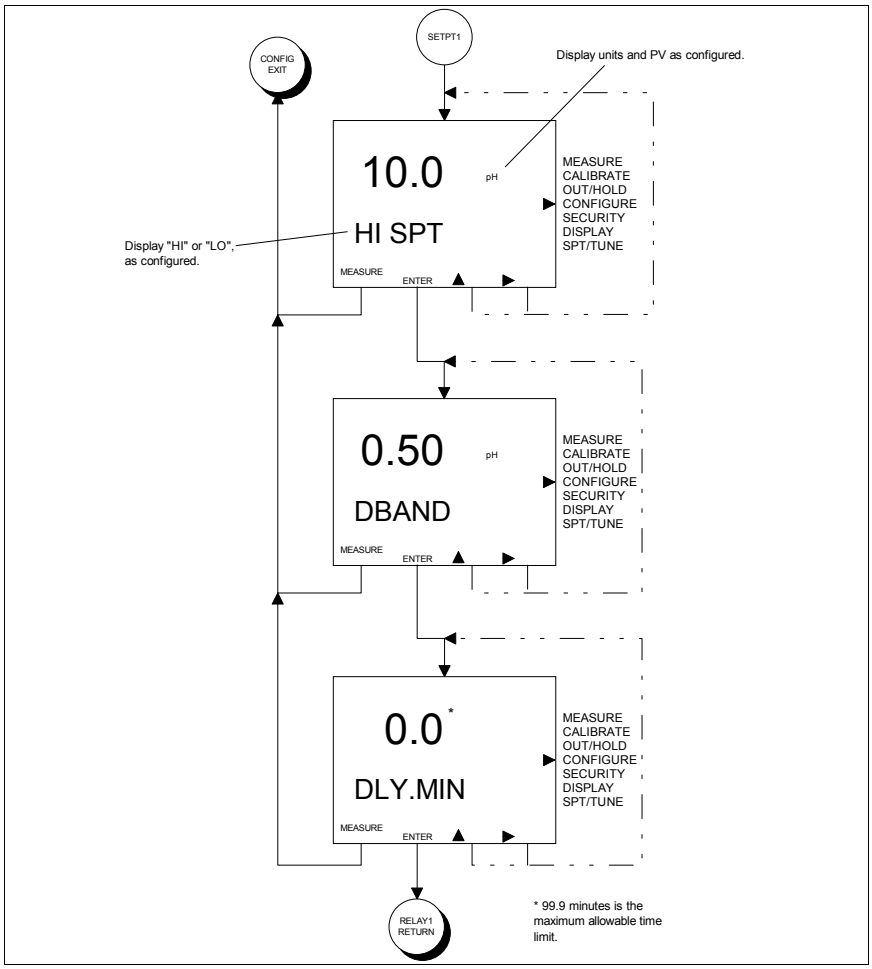


Figure 8-11. Screen Flow Diagram For Setting the Setpoint Relay Output Configure State of Operation.

Diagnostic Relay Output (Basic/Advanced)

A Diagnostic Relay Output simply energizes when a diagnostic condition has been detected. The relay can be configured to trigger on a sensor, instrument, or all diagnostic conditions.

Set the trigger for the Diagnostic Relay Output using Figure 8-12 as reference and the following procedure:

1) Set the Diagnostic trigger using the NEXT Key to toggle between ALL, SENSOR, and INSTR. (i.e., Instrument), and press the ENTER Key to enter the new trigger.

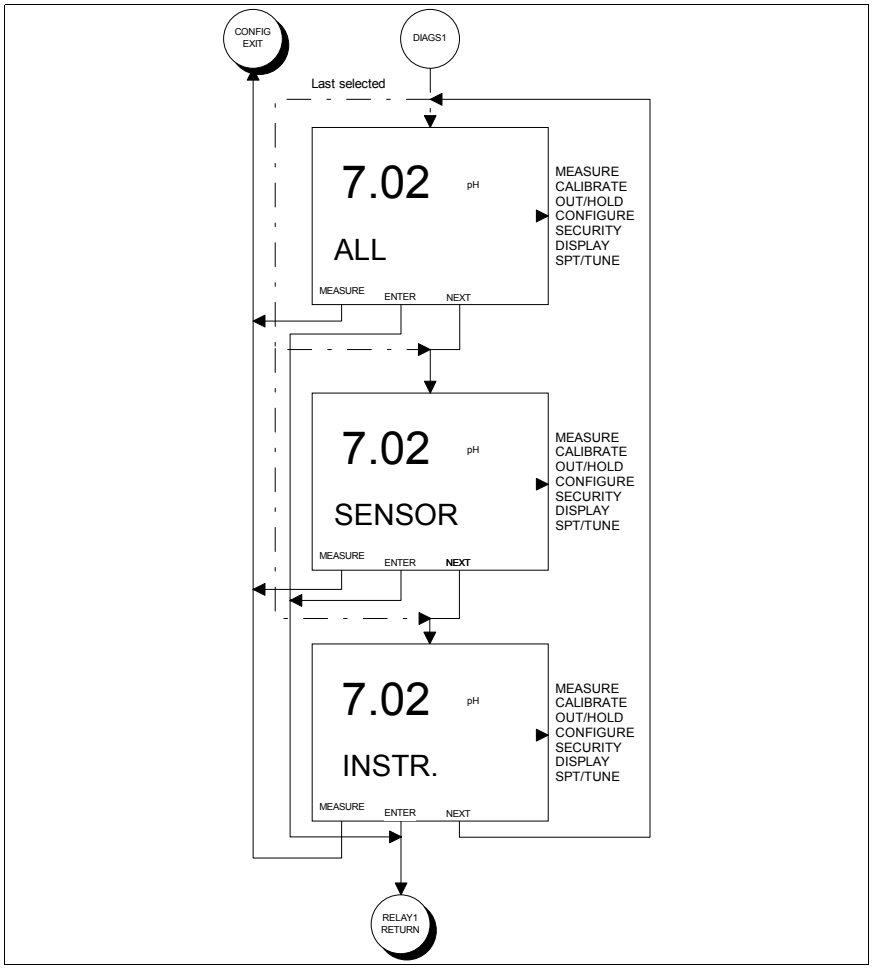


Figure 8-12. Screen Flow Diagram For Setting the Diagnostic Relay Output Configure State of Operation.

Cycle Timer Relay Output (Advanced)

A Cycle Timer can only be sourced to the Process Variable and can energize the relay for either a High or Low setpoint condition.

As with a Setpoint Relay Output, the Setpoint condition functions in the same manner; however, the Deadband control is replaced with the Cycle Time. Thus, a Cycle Timer will energize the Relay Output for a set amount of time (ON.TIME) and de-energize for the remainder of the cycle (CYC.MIN). This cycle repeats until the Setpoint condition is no longer met. For more information on the Cycle Timer, see Section 2, Overview.

Valid Setpoint values are limited to the Process Variable range of the TB84PH Advantage Series analyzer. See Table 1-3, Specifications, for analyzer range values. Valid Cycle Time and On Time values are 0.0 to 99.9 minutes.

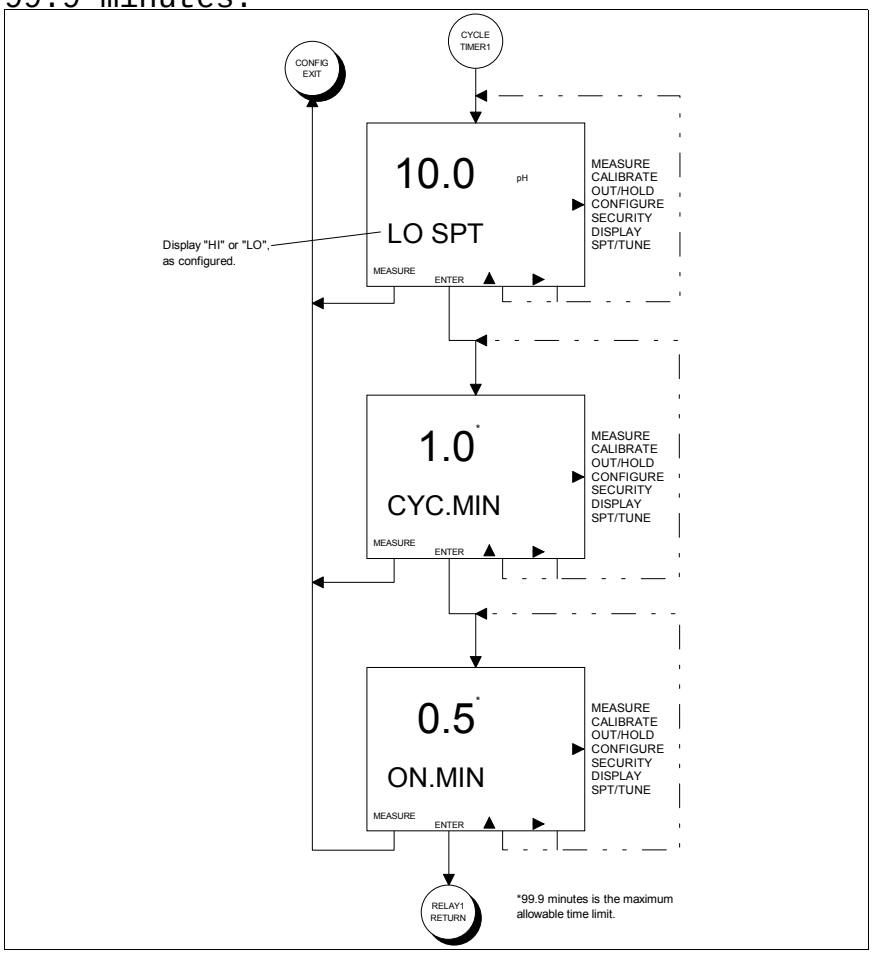


Figure 8-13. Screen Flow Diagram For Setting the Cycle Timer Relay Output Configure State of Operation.

Set the Cycle Timer parameters of a Relay Output using Figure 8-13 as reference and the following procedure:

1) Set the Setpoint (i.e., LO SPT or HI SPT) using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to enter the new value.

2) Set the Cycle Time in minutes (i.e., CYC.MIN) using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to enter the new value.

3) Set the On Time in minutes (i.e., ON.MIN) using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to enter the new value.

Cleaner Relay Output (Advanced)

Automatic sensor cleaning can be accomplished using any one of the three relay outputs. At a prescribed time interval, a Cleaner Relay Output will energize and allow the activation of a cleaning device. While in the energized state, analog and relay outputs can be held to values captured just prior to the cleaning cycle (i.e., energized state). If a relay hold condition is not feasible, non-cleaner relay outputs can be disable during a cleaning cycle.

To specify a cleaning cycle, the Cycle, On, and Recovery Times must be defined. The Cycle Time defines the repeating period between cleaning cycles, the On Time defines the length of time the relay will be energized, and the Recovery Time defines the length of time after the relay has been de-energized before the hold and/or disable condition(s) will be removed. Valid times for Cycle Time are 0.0 to 99.9 hours and for On and Recovery Times are 0.0 to 99.9 minutes.

Set the Cleaner parameters of a Relay Output using Figure 8-14 as reference and the following procedure:

1) Set the Cycle Time in hours (i.e., CYC.HRS) using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to enter the new value.

2) Set the On Time in minutes (i.e., ON.MIN) using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to enter the new value.

3) Set the Recovery Time in minutes (i.e., RCV.MIN) using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to enter the new value.

4) Hold the Analog Outputs (i.e., AO.HLD) during the On and Recovery Times using the YES Key, or leave the Analog Outputs live during the On and Recovery Times using the No Key.

5) Hold the Relay Outputs (i.e., RO.HLD) during the On and Recovery Times using the YES Key, or continue onto the Disable Relay Outputs State during the On and Recovery Times using the No Key.

6) Disable the Relay Outputs (i.e., RO.HLD) during the On and Recovery Times using the YES Key, or leave the Relay Outputs live during the On and Recovery Times using the No Key.

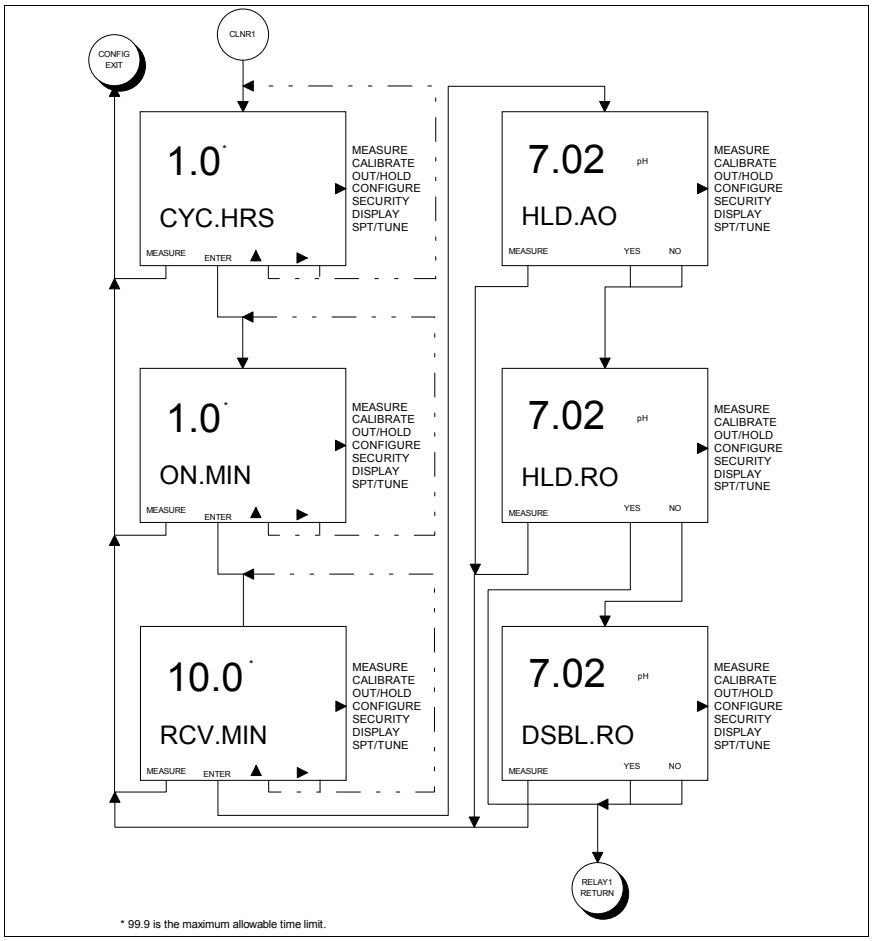


Figure 8-14. Screen Flow Diagram For Setting the Cleaner Relay Output Configure State of Operation.

SECTION 12 - UTILITY MODE

INTRODUCTION

The TB84PH Advantage Series analyzer contains a Utility Mode of Operation that provides access to powerful functions not used during normal operating conditions. These functions have been separated into two categories: Factory and User. Factory functions are strictly reserved for ABB personnel.

User functions include Programming Mode, reset configuration to default settings, remove security, reset all parameters to default settings, and software reboot functions.

FACTORY/USER STATE

The Factory and User States of Operation can be accessed using the hidden fifth key located directly above the NT in the ADVANTAGE text on the keypad. Once the hidden key has been pressed, the textual prompt USER will be displayed in the secondary display region. Pressing the SELECT Smart Key brings the user into the User State, pressing the NEXT Smart Key brings the user to the Factory selection, and pressing the Exit to MEASURE Smart Key escapes back to the Measure Mode.

User State

The User State contains the primary toggle for setting the Programming Mode, three reset functions, and a software reboot operation that initiates a self-test mode. Table 12-1 describes the function of each User State.

The NEXT Smart Key sequentially moves through each of the four User States. This cycle repeats until a state is selected or the escape function is chosen using the Exit to MEASURE Smart Key. To select a state, press the SELECT Smart Key when the desired User State is shown in the secondary display region.

Table 12-1. User States

State	Function
MODE	Sets the Programming Mode that are available in the Modify Configure State of Operation.
RST.CON	Resets the configuration to factory default settings.
RST.SEC	Resets the security password and removes all security.
RST.ALL	Resets all programming parameters such as configuration, calibration, output/hold, security, secondary display, and setpoint/tune functions to factory default settings.
RST.SFT	Resets the analyzer by repeating the boot-up and self-test procedures.

Figure 12-1 identifies the Smart Key assignments and resulting action. The following section describes each of the User States and their applicability.

Advanced/Basic Programming Mode User State

In order to simplify the configuration process for a user who only needs a limited amount of functionality, the TB84PH Advantage Series analyzer contains two types of Programming Modes: Basic and Advanced. The Programming Mode is defined by a nomenclature option.

The Basic Programming Mode contains a reduced set of features found in the Advanced Programming Mode. Reducing the available features helps streamline the configuration process. If the TB84PH Advantage Series analyzer is ordered with Advanced Programming, the Basic or Advanced Programming Mode can be used.

Contact ABB for information on Advanced Programming upgrades.

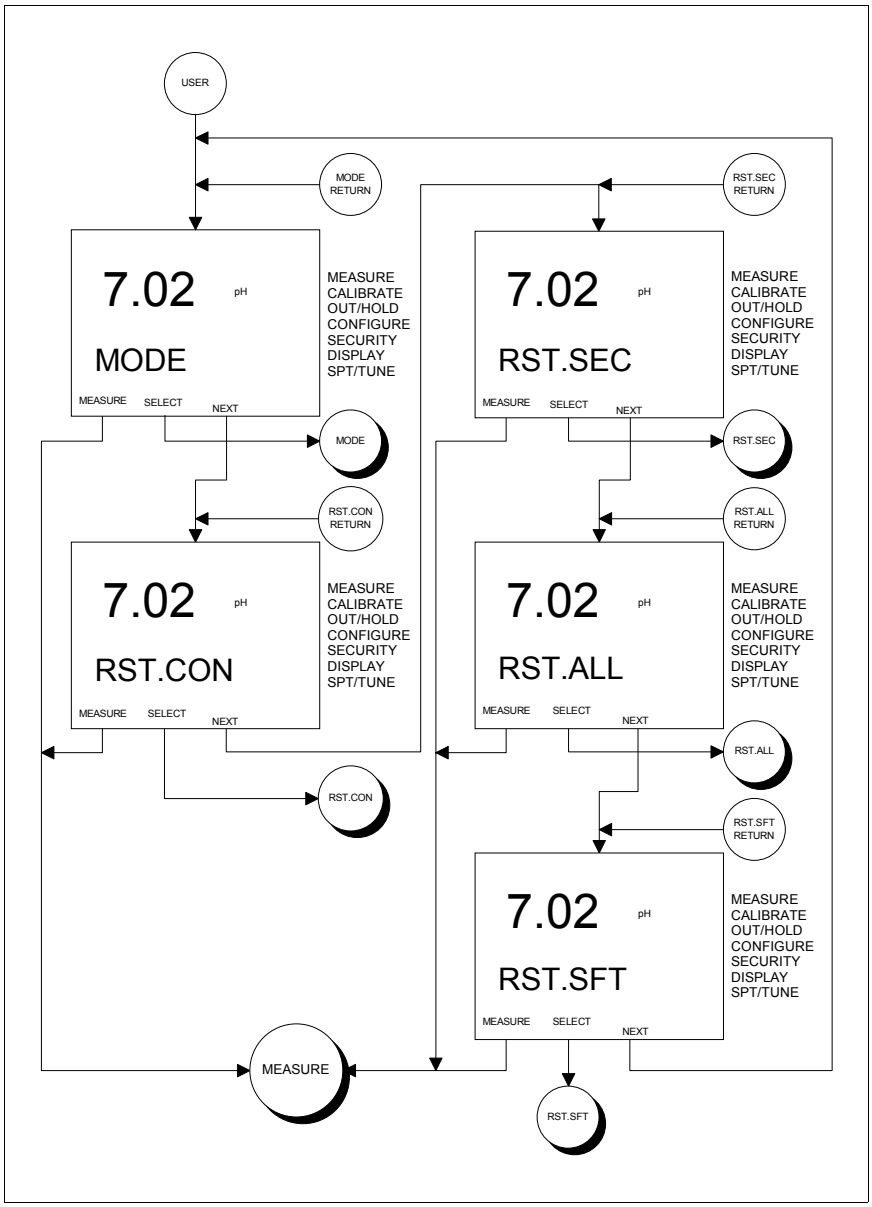


Figure 12-1. Screen Flow Diagram For User States of Operation.

Reset Configuration User State

The Reset Configuration User State returns the configuration to factory default settings. See the Preface or Appendix C, Configuration Worksheets, for software default settings.

To reset the configuration to factory defaults, use the following procedure:

1) Access the User Mode by pressing the hidden button located directly above the NT in the ADVANTAGE text on the keypad. The text USER will appear in the secondary display once the hidden button has been pressed.

2) Press the SELECT Key to access the User Mode. The text MODE will appear in the secondary display.

3) Press the NEXT Key to display RST.CON (i.e., Reset Configuration) text.

4) Press the SELECT Key to reset the configuration.

5) Enter the security password (if the Configure Mode has been secured) using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to enter the password.

6) Confirm the reset operation when the text RESET? is displayed by pressing the YES Key, or abort the reset operation by pressing the NO Key.

Reset Security User State

The Reset Security User State returns the security to factory default settings. The factory default is security OFF for all applicable modes and states (i.e., Calibrate, Output/Hold, Modify Configure, and Setpoint/Tune).

To remove the security, use the following procedure:

1) Access the User Mode by pressing the hidden button located directly above the NT in the ADVANTAGE text on the keypad. The text USER will appear in the secondary display once the hidden button has been pressed.

2) Press the SELECT Key to access the User Mode. The text MODE will appear in the secondary display.

3) Press the NEXT Key until the secondary display region shows RST.SEC (i.e., Reset Security) text.

4) Press the SELECT Key to reset the security.

5) Enter the security password **732** using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to enter the password.

6) Confirm the reset operation when the text RESET? is displayed by pressing the YES Key, or abort the reset operation by pressing the NO Key.

Reset All User State

The Reset All User State returns all analyzer parameters back to factory defaults. This includes calibration, output/hold, configuration, security, secondary display, and setpoint/tune values.

To reset all analyzer parameters, use the following procedure:

1) Access the User Mode by pressing the hidden button located directly above the NT in the ADVANTAGE text on the keypad. The text USER will appear in the secondary display once the hidden button has been pressed.

2) Press the SELECT Key to access the User Mode. The text MODE will appear in the secondary display.

3) Press the NEXT Key until the secondary display region shows RST.ALL (i.e., Reset

ALL) text.

4) Press the SELECT Key to reset all analyzer parameters.

5) Enter the security password **255** using the ▲ Key to increment the blinking digit and the ▶ Key to move to the next digit, and press the ENTER Key to enter the password.

6) Confirm the reset operation when the text RESET? is displayed by pressing the YES Key, or abort the reset operation by pressing the NO Key.

Soft Boot User State

The Soft Boot User State initiates a software reset. The software reset initiates boot-up and self-test procedures. All programmable instrument parameters are unaffected by this function.

To reboot the analyzer without affecting any instrument parameters, use the following procedure:

1) Access the User Mode by pressing the hidden button located directly above the NT in the ADVANTAGE text on the keypad. The text USER will appear in the secondary display once the hidden button has been pressed.

2) Press the SELECT Key to access the User Mode. The text MODE will appear in the secondary display.

3) Press the NEXT Key until the secondary display region shows RST.SFT (i.e., Reset ALL) text.

4) Press the SELECT Key to initiate the reboot operation.

5) Confirm the reboot operation when the text RESET? is displayed by pressing the YES Key, or abort the reset operation by pressing the NO Key.

SECTION 13 - DIAGNOSTICS

INTRODUCTION

The TB84PH Advantage Series analyzer performs a number of diagnostic checks on hardware, software, and sensor functions. If a nonconforming condition is detected, the user is alerted to faults locally by a flashing FAULT indicating icon and, if configured, remotely by modulating Analog Output One (i.e., Spike Output)and/or energizing a Relay Output (i.e., Diagnostic Relay Output).

Diagnostic faults are interrogated using the FAULT Info Smart Key. A short text string and fault code are alternately shown in the secondary display region. If multiple faults exist, the FAULT Info Smart Key moves the user to the next fault. Once all faults have been interrogated, the analyzer returns to the Measure Mode of Operation.

The following section describes the types of fault conditions and their applicability to the TB84PH Advantage Series functionality.

FAULT CODES

Fault conditions are grouped into two categories based on severity. Conditions that result in degradation of analyzer performance are reported as Problem Codes (PC), while conditions that render the analyzer inoperable are reported as Error Codes (EC).

Fault codes are reported in the secondary display region in a first in, first out order (i.e., the first detected fault condition is the first condition that is displayed upon interrogation). All active fault conditions can be viewed at any time while in the Measure Mode using the FAULT Info Smart Key. A flashing Fault icon indicates a new fault condition that has not been interrogated. A non-flashing Fault icon indicates all fault conditions have been interrogated but not resolved. When all fault conditions are resolved, the Fault icon and FAULT Info Smart Key are de-energized.

Problem Codes

Problem Codes result from fault conditions that impact the performance of the TB84PH Advantage Series analyzer. In most cases, these conditions can be resolved by the user using standard practices.

The occurrence of a Problem Code fault condition triggers the Fault icon to energize, the Spike output to modulate (if configured), and a Diagnostic Relay Output to energize (if configured). These diagnostic indicators provide local and remote reporting capability.

Tables 13-1 and 13-2 contain all the Problem Codes supported by the TB84PH Advantage Series analyzer. Each entry lists the Problem Code number, displayed text string, and a short description of the fault. See Section 14, Troubleshooting, for resolving a fault condition.

Table 13-1. Common Problem Code Definitions

Problem Codes	Text String	Description
PC1	LO.GLS.Z	Low pH measuring electrode impedance.
PC2	HI.REF.Z	High reference electrode impedance.
PC4	GND LP	Ground Loop present or shorted sensor cable.
PC5	OPEN	Open sensor cable or sensor out of solution.
PC6	HI.AO1	Analog Output One above upper range value (+0.4 mA Hystersis).
PC7	LO.AO1	Analog Output One below lower range value (-0.2 mA Hystersis). Fault only applicable for 4-20 mA configurations.
PC8	HI.PV	Process Variable above analyzer range.
PC9	LO.PV	Process Variable below analyzer range.
PC10	HI.TEMP	Temperature above analyzer range.
PC11	LO.TEMP	Temperature below analyzer range.
PC12	HI.T.AD	Open or missing temperature sensor.
PC13	LO.T.AD	Shorted temperature sensor.
PC14	+HI.OFF	Large positive sensor offset (greater than 180 mV).
PC15	-HI.OFF	Large negative sensor offset (less than -180 mV).
PC16	HI.EFF	High sensor efficiency (greater than 110%).
PC17	LO.EFF	Low sensor efficiency (less than 60%).
PC18	HI.AO2	Analog Output Two above upper range value (+0.4 mA Hystersis).
PC19	LO.AO2	Analog Output Two below lower range value (+0.4 mA Hystersis). Fault only applicable for 4-20 mA configurations.

Table 13-2. Uncommon Problem Code Definitions

Problem Codes	Text String	Description
PC20	BAD.SEE	Bad Serial EEPROM or pH/ORP/pION Input PCB Assembly.

Problem Codes	Text String	Description
PC21	NO.F.CAL	Missing factory calibration and functional Serial EEPROM.
PC22	BLNK.uP	Blank microprocessor EEPROM.
PC23	SEE.EMI	Unverifiable SEEPROM bus read operation.
PC24	ROM.EMI	Unverifiable EEPROM/ROM bus read operation.
PC25	ROM.SUM	Incorrect EPROM Checksum.
PC30	PV.F.CAL	Out of range or missing factory calibration for the Process Variable.
PC31	BA.F.CAL	Out of range or missing factory calibration for 3k Balco temperature sensor.
PC32	PT.F.CAL	Out of range or missing factory calibration for Pt100 temperature sensor.
PC33	RZ.F.CAL	Out of range or missing factory calibration for reference impedance measurement.
PC34	PV.CHKS	Incorrect or missing Process Variable checksum.
PC35	BA.CHKS	Incorrect or missing 3k Balco temperature sensor checksum.
PC36	PT.CHKS	Incorrect or missing Pt100 temperature sensor checksum.
PC37	PZ.CHKS	Incorrect or missing reference impedance measurement checksum.
PC40	HI.R.CKT	Reference impedance circuit failure - High range error.
PC41	LO.R.CKT	Reference impedance circuit failure - Low range error.
PC42	HI.RZ.AD	Reference impedance above analyzer A/D range.
PC43	LO.RZ.AD	Reference impedance below analyzer A/D range.
PC44	HI.G.CKT	pH measuring electrode impedance circuit failure - High range error.
PC45	LO.G.CKT	pH measuring electrode impedance circuit failure - Low range error.
PC46	HI.GL.AD	pH measuring electrode impedance above analyzer A/D range.
PC47	LO.GL.AD	pH measuring electrode impedance below analyzer A/D range.
PC48	HI.C.CKT	Cable diagnostic circuit failure - High range error.
PC49	LO.C.CKT	Cable diagnostic circuit failure - Low range error.
PC50	HI.CA.AD	Cable diagnostic signal above analyzer A/D range.
PC51	LO.CA.AD	Cable diagnostic signal below analyzer A/D range.

Error Codes

Error Codes result from fault conditions that render the TB84PH Advantage Series analyzer inoperable. In most cases, these conditions can not be resolved by the user using standard methods.

The occurrence of an Error Code fault

condition triggers the Fault icon to energize and the Safe Mode outputs to enable (i.e., the Analog Output One and Two currents are fixed high or low based on the configured Safe Mode levels). These diagnostic indicators provide local and remote reporting capability.

Table 13-3 contains all the Error Codes supported by the TB84PH Advantage Series analyzer. Each entry lists the Error Code number, displayed text string, and a short description of the fault condition. See Section 14, Troubleshooting, for resolving a fault condition.

Table 13-3. Error Code Definitions

Error Codes	Text String	Description
EC1	HI.PV.AD	Over range Process Variable A/D.
EC2	LO.PV.AD	Under range Process Variable A/D.
EC4	TC.PCB	Toroidal conductivity board with pH/ORP/pION firmware.
EC5	DO.PCB	Dissolved Oxygen board with pH/ORP/pION firmware.
EC6	TE.PCB	Two-electrode conductivity board with pH/ORP/pION firmware.
EC7	EC.PCB	Four-electrode conductivity board with pH/ORP/pION firmware.

Calibration Diagnostic Messages

The TB84PH Advantage Series analyzer performs automatic efficiency and offset calculations relative to a theoretically perfect electrochemical and/or temperature sensor during each calibration cycle. Calibration history is retained for future interrogation using the Edit Calibrate State. The calibration constants that are displayed are Efficiency and Offset for the Process Variable and Slope and Offset for the Temperature.

An Efficiency of less than 60% or greater than 110% indicates a potentially bad process calibration point or poor performing sensor. Calibration values that yield Efficiency values less than 40% or greater than 150% are not accepted. In these cases, the text string BAD.CAL (i.e., bad calibration) is displayed in the secondary display region. The user is returned to the beginning of the calibration cycle after the bad calibration has been reported.

An Offset value of less than -180.0 mV or greater than +180 mV also indicates a potentially bad process calibration or poor performing sensor. Calibration values that yield Offset values less than -1000 mV or greater than +1000 mV are not accepted. Again, a bad calibration will be reported, and the user returned to the beginning of the calibration cycle.

For temperature, a bad calibration will be reported and calibration values will not be accepted for Slope values that are less than 0.2 or greater than 1.5 and Offset values that are less than -40°C or greater than +40°C. Temperature calibrations use smart software routines that automatically adjust the Slope, Offset, or both values based on the calibration value being entered and calibration history if it exists.

Additional Diagnostic Messages

Other diagnostic messages may appear during analyzer programming. These messages include BAD.VAL (i.e., bad value) and DENIED.

BAD.VAL indicates the attempted numeric entry of a value which is out of the allowed analyzer range. See Table 1-3, Specifications, for analyzer range limits.

DENIED indicates incorrect entry of a security password. See Section 9, Security Mode, for information on the Security Mode of Operation.

RAM.ERR indicates a Random Access Memory read/write error. The analyzer will automatically reset when this error has been encountered. If the analyzer continues to reset, contact ABB for problem resolution.

SECTION 14 - TROUBLESHOOTING

INTRODUCTION

This section provides troubleshooting information for the TB84PH Advantage Series analyzer and associated sensor. Using Table 14-1, problem and error conditions can be identified and the corrective action for these conditions can be tested. Refer to Section 13, Diagnostics, for descriptions of problem and error code conditions.

ANALYZER TROUBLESHOOTING

Table 14-1. Analyzer Troubleshooting Guide

Problem Code	Problem Text String	Corrective Action
PC1	LO.GLS.Z	1) Verify sensor wiring is properly connected. 2) Verify glass electrode is intact. Replace sensor if glass electrode is broken. 3) Remove any liquids, oils, scales or corrosion from TB84PH terminal block or extension cable junction box terminals. Replace extension cable if corrosion is present. 4) Verify sensor responds to pH buffers. Replace sensor if sensor does not respond. 5) Change configuration to proper analyzer type if sensor is not a glass pH sensor.
PC2	HI.REF.Z	1) Verify sensor wiring is properly connected. 2) Verify reference is clean. Remove any foreign material. See Section 14, Maintenance. 3) Clean sensor then verify sensor responds to pH buffers. Replace sensor if sensor does not respond. 4) Change configuration to increase reference impedance limit if sensor is functioning properly in buffers and in the final installed location.
PC4	GND LP	1) Verify sensor wiring is properly connected. 2) Verify sensor does not have any exposed wires from nicks or equivalent. Repair if possible or replace. 3) Remove any liquids, oils, scales or corrosion from TB84PH terminal block or extension cable junction box terminals. Replace extension cable if corrosion is present. 4) Verify sensor responds to pH buffers. Replace sensor and/or sensor extension cable (if present) if sensor does not respond. 5) Electronically test sensor. Replace sensor if sensor does not meet requirements.
PC5	OPEN	1) See PC4 corrective actions.

Problem Code	Problem Text String	Corrective Action
PC6	HI.AO1	1) Verify process conditions are within configured output range. If process variable is outside configured range, increase output range. 2) Verify sensor wiring is properly connected. 3) Remove any liquids, oils, scales or corrosion from TB84PH terminal block or extension cable junction box terminals. Replace extension cable if corrosion is present. 4) Clean sensor and perform a buffer and process calibration. 5) Conduct a temperature calibration. If a temperature sensor is not being used, verify the analyzer is configured for TMP.SNS “NONE”. 6) Electronically test the sensor and temperature compensator. Replace sensor if sensor does not meet requirements.
PC7	LO.AO2	1) See PC6 corrective actions.
PC8	HI.PV	1) Verify process conditions are within analyzer range. Process variable must be within analyzer range. 2) Also See PC4 corrective actions.
PC9	LO.PV	1) See PC8 corrective actions.
PC10	HI.TEMP	1) Verify process conditions are within analyzer range. Process variable must be within analyzer range. 2) Also see PC6 corrective actions.
PC11	LO.TEMP	1) See PC10 corrective actions.
PC12	HI.T.AD	1) See PC10 corrective actions. If all items check out, implement item 2. 2) Replace pH/ORP/pION Input PCB Assembly.
PC13	LO.T.AD	1) See PC12 corrective actions.
PC14	+HI.OFF	1) Clean Sensor and repeat buffer and/or process calibration. 2) Inspect sensor and cabling for shorts. Remove all potential shorts to ground, conduit or metal surfaces. 3) If sensor is functioning properly, order a spare sensor to replace the existing sensor. Replace existing sensor with spare when analyzer does not accept calibration values.
PC15	-HI.OFF	1) See PC14 corrective actions.
PC16	HI.EFF	1) Verify the proper buffer values were used for calibration and repeat buffer calibration. 2) Clean sensor and repeat buffer calibration.

Problem Code	Problem Text String	Corrective Action
PC17	LO.EFF	1) Verify the proper buffer values were used for calibration and repeat buffer calibration. 2) Clean sensor and repeat buffer calibration. 3) Look for shorts in the sensor and extension cable, if present. Remove all potential shorts. 4) Remove any liquids, oils, scales or corrosion from TB84PH terminal block or extension cable junction box terminals. Replace extension cable if corrosion is present. 5) If sensor is functioning properly, order a new sensor to replace existing sensor once the analyzer does not accept calibration values.
PC18	HI.AO2	1) See PC6 corrective actions.
PC19	LO.AO2	2) See PC6 corrective actions.
PC20	BAD.SEE	1) Input PCB Factory calibration constants can not be loaded. Calibrate sensor and order replacement pH/ORP/pION Input PCB Assembly. Existing PCB should properly function until new assembly is received.
PC21	NO.F.CAL	1) Contact Factory for calibration procedure. Calibrate sensor for short-term usage until factory calibration can be performed.
PC22	BLNK.uP	1) Cycle analyzer power. 2) Contact Factory.
PC23	SEE.EMI	1) See PC22 corrective action.
PC24	ROM.EMI	1) See PC22 corrective action.
PC25	ROM.SUM	1) See PC22 corrective action.
PC30	PV.F.CAL	1) Contact Factory for calibration procedure. Calibrate sensor for short-term usage until factory calibration can be performed.
PC31	BA.F.CAL	1) Contact Factory for calibration procedure. Calibrate temperature sensor for short-term usage until factory calibration can be performed.
PC32	PT.F.CAL	1) See PC31 corrective action.
PC33	RZ.F.CAL	1) Contact Factory for calibration procedure. Reference impedance diagnostic will not be operational until factory calibration is performed. Disable Di agnostics until factory calibration can be performed.
PC34	PV.CHKS	1) Cycle analyzer power. 2) Remove analyzer from installed location and relocate to a noise-free environment. If problem does not appear, the analyzer will need a different final location or additional shielding of the analyzer and/or wiring is necessary for proper function. 3) Contact Factory.

Problem Code	Problem Text String	Corrective Action
PC35	BA.CHKS	1) See PC34 corrective actions.
PC36	PT.CHKS	1) See PC34 corrective actions.
PC37	PZ.CHKS	1) See PC34 corrective actions.
PC40	HI.R.CKT	1) See PC2 corrective actions. If the sensor and connections are not the cause, proceed to item 2. 2) Input PCB reference impedance circuit failure exists. Disable diagnostics and order replacement pH/ORP/pION Input PCB Assembly. Existing PCB should properly function until new assembly is received.
PC41	LO.R.CKT	1) Verify sensor wiring is properly connected. 2) Electronically test the sensor. Replace sensor if sensor does not meet requirements. 3) Input PCB reference impedance circuit failure exists. Disable diagnostics and order replacement pH/ORP/pION Input PCB Assembly. Existing PCB should properly function until new assembly is received.
PC42	HI.RZ.AD	1) Input PCB reference impedance circuit failure exists. Disable Diagnostics and order replacement pH/ORP/pION Input PCB Assembly. Existing PCB should properly function until new assembly is received.
PC43	LO.RZ.AD	1) See PC42 corrective actions.
PC44	HI.G.CKT	1) See PC4 corrective actions. If the sensor and connections are not the cause, proceed to item 2. 2) Input PCB glass pH impedance circuit failure exists. Disable diagnostics and order replacement pH/ORP/pION Input PCB Assembly. Existing PCB should properly function until new assembly is received.
PC45	LO.G.CKT	1) See PC1 corrective actions. If the sensor and connections are not the cause, proceed to item 2. 2) Input PCB glass pH impedance circuit failure exists. Disable Diagnostics and order replacement pH/ORP/pION Input PCB Assembly. Existing PCB should properly function until new assembly is received.

Problem Code	Problem Text String	Corrective Action
PC46	HI.GL.AD	1) Input PCB glass pH impedance circuit failure exists. Disable diagnostics and order replacement pH/ORP/pION Input PCB Assembly. Existing PCB should properly function until new assembly is received.
PC47	LO.GL.AD	1) See PC46 corrective actions.
PC48	HI.C.CKT	1) Verify sensor wiring is properly connected. 2) Remove any liquids, oils, scales or corrosion from TB84PH terminal block or extension cable junction box terminals. Replace extension cable if corrosion is present. 3) Electronically test the sensor. Replace sensor if sensor does not meet requirements. 4) Input PCB cable diagnostic circuit failure exists. Disable Diagnostics and order replacement pH/ORP/pION Input PCB Assembly. Existing PCB should properly function until new assembly is received.
PC49	LO.C.CKT	1) See PC48 corrective actions.
PC50	HI.CA.AD	1) Input PCB cable diagnostic circuit failure exists. Disable Diagnostics and order replacement pH/ORP/pION Input PCB Assembly. Existing PCB should properly function until new assembly is received.
PC51	LO.CA.AD	1) See PC50 corrective actions.

WARNING **All error conditions are considered catastrophic. When such an error has been reported, the analyzer should be replaced with a known-good analyzer. The non-functional analyzer should be returned to the factory for repair. Contact the factory for a Return Materials Authorization (RMA) number.**

SENSOR TROUBLESHOOTING

If the sensor is suspected of being the source of problems, a quick visual inspection in many cases will identify the problem. If nothing can be seen, a few electrical tests using a digital multimeter can be performed to determine if the sensor is at fault. Some of these tests can be performed with the sensor either in or out of the process stream.

Visual Sensor Inspection

Remove the sensor from the process and

visually check the following:

Sensor body
Inspect the sensor body for cracks and distortions. If any are found, contact ABB for alternative sensor styles and materials.

Cable and connectors
Inspect the sensor cable for cracks, cuts, or shorts. If a junction box and/or extension cable are used, check for moisture, oil, corrosion, and/or particulates. All connections must be dry, oil-free, corrosion-free, and particulate-free. Even slight amounts of moisture, skin oils, corrosion, and particulates can short sensor signals due to the high impedance of these signals. If a BNC connector is used, check to see that it is dry and not shorting against any metal, earth grounds, or conduit.

Measuring electrode
Inspect the glass electrode for breaks or cracks. If breakage is a problem, contact ABB for alternative electrode choices or suggestions regarding alternate sensor mounting locations.

Inspect the measurement electrode for foulants or scales. Many scales are not noticeable when the sensor is wet. Using a tissue, dry the glass electrode and hold it up to a bright light. Scaling will appear as a whitish, textured material on the surface of the electrode. Films will usually have a streaky, multi-colored appearance. Clean the electrode if it is fouled or scaled. See Section 15, Maintenance, for sensor cleaning procedures.

Reference junction
Inspect the reference junction (the area between the sensor body and measuring electrode) for heavy foulants or scaling. If foulants or hardness scales are present, remove foreign material using the procedures described in Section 15, Maintenance.

When mechanically cleaning the sensor, always use a soft bristle brush in order to avoid damaging the insulating coating on the solution ground (i.e., the metallic collar around the measuring electrode if present). This coating is only present on the outer diameter next to the reference junction and must be intact for the reference diagnostics to function properly.

If the junction (especially a wood junction) has been attacked by the process chemicals, contact ABB for alternate junction materials.

Solution ground and O-ring seals
On TBX Advantage sensors, inspect the solution ground (i.e., the metallic collar around the measuring electrode if present) and sealing O-rings for attack by the process liquid. If the solution ground shows evidence of corrosion or deterioration and/or the O-rings appear distorted or swollen, contact ABB for alternate material choices.

Sensor Electronic Test

The pH/ORP/pION sensor can be electronically tested to verify the integrity of the sensor elements and cable. These tests require a Digital Multimeter (DMM) that has a conductance function capable of measuring from 0 to 200 nS.

The sensor leads and automatic temperature compensator leads must be disconnected from the analyzer before these tests can be performed. Also the sensor must be placed in a container of water or buffer solution. If the sensor is a standard ABB sensor (i.e., TB5) which does not have a solution ground and has a BNC, the center conductor will be equivalent to the blue lead (i.e., Sense) and the shell will be equivalent to the black lead (i.e., Reference). Check the sensor using the following procedure.

1. Check the resistance of the Temperature Compensator. For a 3 kohm Balco RTD, the expected resistance can be calculated from:

$$R_{TC}=(((T-25)*0.0045)+1)*3000$$

where T is in degrees Celsius. The measured resistance should be within the expected value by ± 15%. At room temperature (i.e., 25°C), the resistance value should be approximately 3 kohms.

For a Pt100 RTD, the expected resistance can be calculated from:

$$R_{TC}=100+((T-0)*0.385)$$

where T is in degrees Celsius. The measured resistance should be within the expected value by ± 5%. At room temperature (i.e., 25°C), the resistance value should be approximately 110 ohms.

2. Check the conductance between the red Temperature Compensator lead and each of the other sensor leads (i.e., blue, yellow, black, green, and heavy green leads). The reading must be less than 0.05 nS.

3. Check the conductance between the yellow Guard lead and each of the other sensor leads (i.e., blue, black, green, red, white, and heavy green leads). The reading must be less than 0.05 nS.

4. Check the conductance between the heavy green lead (i.e., Shield) and each of the other sensor leads (i.e., blue, yellow, black, green, red, and white leads). The reading must be less than 0.05 nS.

5. Check the conductance of the sensor measurement electrode by measuring across the blue and green leads. The conductance must be 1 to 10 nS when the sensor and solution in contact with the sensor is at 25°C. (If the sensor and solution are above or below 25°C, the conductance value can be estimated as one-half the conductance for every eight degrees above 25°C or double the conductance for every eight degrees below 25°C.)

6. Check the voltage of the sensor reference electrode by measuring across the black lead for the sensor under test and the black lead of a known good sensor. For this test, the sensor under test must be removed from the process and placed into a buffer solution. The known good sensor must also be placed in the same buffer solution. The voltage must be between -180 mV and +180 mV.

SECTION 15 - MAINTENANCE

INTRODUCTION

The reliability of any stand-alone product or control system is affected by maintenance of the equipment. ABB recommends that all equipment users practice a preventive maintenance program that will keep the equipment operating at an optimum level.

Personnel performing preventive maintenance should be familiar with the TB84PH Advantage Series analyzer.

WARNING	**Allow only qualified personnel (refer to INTENDED USER in SECTION 1 - INTRODUCTION) to commission, operate, service or repair this equipment. Failure to follow the procedures described in this instruction or the instructions provided with related equipment can result in an unsafe condition that can injure personnel and damage equipment.**

PREVENTIVE MAINTENANCE

Table 15-1 is the preventive maintenance schedule and check list for the TB84PH Advantage Series analyzer. The table lists the preventive maintenance tasks in groups according to their specified maintenance interval. The maintenance intervals are recommendations and may vary depending on the location environment and the process application. As a minimum, these recommended maintenance tasks should be performed during an extended process shutdown. Tasks in Table 15-1 are self-explanatory. For sensor cleaning procedures, refer to CLEANING THE SENSOR.

Table 15-1. Preventive Maintenance Schedule

Preventive Maintenance Tasks	Interval (months)
Check and clean all wiring and wiring connections	12
Clean and inspect sensor	As required.
Clean and lubricate all gaskets and O-rings	Each time seals are broken.
Analyzer output calibration	12
Sensor calibration	As required.

Cleaning the Sensor

ABB pH/ORP/pION sensors are cleaned using one or a combination of the following methods. These are recommendations and may not be suitable for all applications. Other cleaning methods may be developed that better suit particular applications. When cleaning, observe all safety precautions required for handling chemicals. When handling chemicals, always use gloves, eye protection, safety shield, and similar protective items, and consult ***Material Safety Data Sheets***.

WARNING **Consider the material compatibility between cleaning fluids and process liquids. Incompatible fluids can react with each other causing injury to personnel and equipment damage.**

WARNING **Use solvents only in well ventilated areas. Avoid prolonged or repeated breathing of vapors or contact with skin. Solvents can cause nausea, dizziness, and skin irritation. In some cases, overexposure to solvents has caused nerve and brain damage. Solvents are flammable - do not use near extreme heat or open flame.**

Acid Dip Dip the tip of the sensor into a one to five percent hydrochloric acid (HCl) solution until this region is free of the unwanted coating. Minimize expose of any metal on the sensor, if present, to this cleaning solution. Corrosion may occur. This method removes scales from water hardness. After dipping, rinse sensor with water.

Solvent Dip Dip the sensor into a solvent such as isopropyl alcohol. Remove solvent using a clean cloth. Do not use solvents which are known to be incompatible with the plastic of the sensor. This method removes organic coatings. After dipping, rinse sensor with water.

Physical Cleaning Use a rag, acid brush, or tooth brush to remove especially thick scales and accumulations. Take caution in cleaning the glass pH electrode, if present, to prevent glass breakage.

When mechanically cleaning the sensor, always use a soft bristle brush in order to avoid damaging the insulating coating on the solution ground (i.e., the metallic collar around the measuring electrode if present). This coating is only present on the outer diameter next to the reference junction and must be intact for the reference diagnostics to function properly.

SECTION 16 - REPLACEMENT PROCEDURES

INTRODUCTION

Due to the modular design of the TB84PH Advantage Series analyzer, the replacement of an assembly can be easily completed. Replacements are available for each major assembly. These include the pH/ORP/pION input PCB, microprocessor PCB, power supply PCB, front bezel, shell, and rear cover assemblies. This section provides removal and installation procedures for these assemblies. Use Figure 16-1 as a reference during removal and installation procedures.

NOTE: Refer to Section 3 for special handling procedures when removal of electronic assemblies is required.

WARNING	**Substitution of any components other than those assemblies listed in this section will compromise the certification listed on the analyzer nameplate. Invalidating the certifications can lead to unsafe conditions that can injure personnel and damage equipment.**

WARNING	**Do not disconnect equipment unless power has been switched off at the source or the area is known to be nonhazardous. Disconnecting equipment in a hazardous location with source power on can produce an ignition-capable arc that can injure personnel and damage equipment.**

ELECTRONIC ASSEMBLY REMOVAL/REPLACEMENT

1. Turn off power to the analyzer. Allow at least 1 minute for the analyzer to discharge.

2. Remove the Front Bezel Assembly by unscrewing the four captive screws and lightly pulling the bezel from the shell.

3. Remove the four 6-32 machine screws that retain the Power Supply and pH/ORP/pION Input PCB assemblies if both assemblies or the Microprocessor PCB Assembly are being replaced.

4. Release the keypad ribbon cable connector latch located on the outside edges of the connector and remove the ribbon cable from the connector.

5. Remove the two 6-32 machine screws that retain the Microprocessor PCB Assembly.

6. Replace the appropriate PCB assembly and follow the reverse of this procedure to re-assemble the analyzer.

FRONT BEZEL ASSEMBLY REMOVAL/REPLACEMENT

1. Turn off power to the analyzer. Allow at least 1 minute for the analyzer to discharge.

2. Remove the Power Supply, pH/ORP/pION Input, Microprocessor PCB Assemblies as described in Electronic Assembly Removal/Replacement procedure.

3. Attach the Power Supply, pH/ORP/pION Input, and Microprocessor PCB Assemblies to the new Front Bezel Assembly, and install it into the Shell Assembly as described in Electronic Assembly Removal/Replacement procedure.

SHELL ASSEMBLY REMOVAL/REPLACEMENT

1. Turn off power to the analyzer. Allow at least 1 minute for the analyzer to discharge.

2. Remove the Front Bezel Assembly by unscrewing the four captive screws and lightly pulling the bezel from the shell.

3. Remove the Rear Cover Assembly by unscrewing the four captive screws.

4. Replace the old Shell Assembly with the new one.

5. Install the Rear Cover and Front Bezel Assemblies and tighten the eight captive screws.

REAR COVER ASSEMBLY REMOVAL/REPLACEMENT

1. Turn off power to the analyzer. Allow at least 1 minute for the analyzer to discharge.

2. Remove the Rear Cover Assembly by unscrewing the four captive screws.

3. Replace with the new Rear Cover Assembly.

4. Tighten the four captive screws.

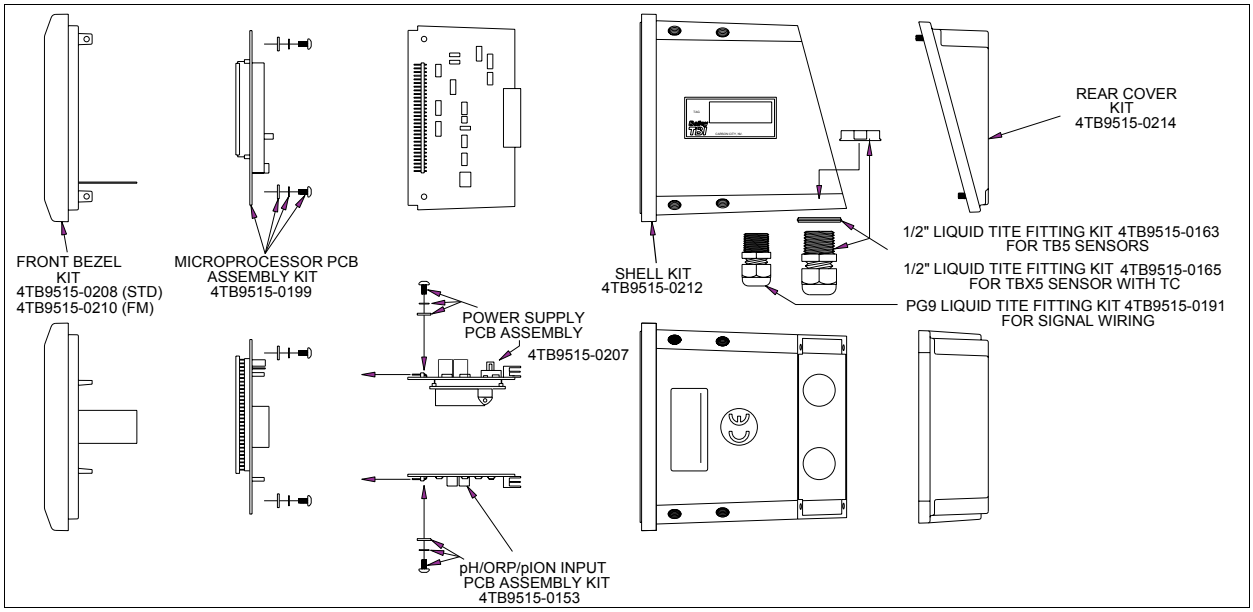


Figure 16-1. TB84PH Advantage Series Exploded View Showing Kit Assignments.

SECTION 17 - SUPPORT SERVICES

INTRODUCTION

ABB Controls is ready to help in the use and repair of its products. Requests for sales and/or application services should be made to the nearest sales or service office.

Factory support in the use and repair of the TB84PH Advantage Series analyzer can be obtained by contacting:

ABB Inc.
9716 S. Virginia ST., Ste.E
Reno, Nevada 89511 USA
Phone: 1(775)850-4800
Facsimile: 1(775)850-4808
Web Site: www.abb.com/instrumentation

RETURN MATERIALS PROCEDURES

If any equipment should need to be returned for repair or evaluation, please contact ABB Inc. at (775)883-4366, or your local ABB representative for a Return Materials Authorization (RMA) number. At the time the RMA number is given, repair costs will be provided, and a customer purchase order will be requested. The RMA and purchase order numbers must be clearly marked on all paperwork and on the outside of the return package container (i.e., packing box).

Equipment returned to ABB Inc. with incorrect or incomplete information may result in significant delays or non-acceptance of the shipment.

REPLACEMENT PARTS

When making repairs at your facility, order spare parts kits from a ABB sales office. Provide the following information.

1. Spare parts kit description, part number, and quantity.

2. Model and serial number (if applicable).

3. ABB instruction manual number, page number, and reference figure that identifies the spare parts kit.

When you order standard parts from ABB, use the part numbers and descriptions from **RECOMMENDED SPARE PARTS KITS** sections. Order

parts without commercial descriptions from the nearest ABB sales office.

RECOMMENDED SPARE PARTS KITS

Table 17-1. Spare Parts Kits

Part Number	Description
4TB9515-0124	Pipe Mount Kit
4TB9515-0125	Hinge Mount Kit
4TB9515-0123	Panel Mount Kit
4TB9515-0156	Wall Mount Kit
4TB9515-0208	Front Bezel Kit - Standard
4TB9515-0210	Front Bezel Kit - FM Version
4TB9515-0212	Shell Kit
4TB9515-0214	Rear Cover Kit
4TB9515-0163	½" Liquid-Tite Cable Grip Fitting Kit - Compatible with TBX5 Sensors
4TB9515-0165	½" Liquid-Tite Cable Grip Fitting Kit - Compatible with TB5 Sensors
4TB9515-0191	PG9 Liquid-Tite Cable Grip Fitting Kit - Compatible with most signal cabling sizes
4TB9515-0198	Complete Cable Grip Kit - Two ½" Liquid-Tite Cable Grips (p/n 4TB9515-0165) and three PG9 Liquid-Tite Cable Grips (p/n 4TB9515-0165)
4TB9515-0207	Power Supply PCB Assembly Kit
4TB9515-0199	Microprocessor PCB Assembly Kit
4TB9515-0153	pH/ORP/pION Input PCB Assembly Kit
4TB9515-0164	BNC/TC to TB84PH Pin Adapter
4TB9515-0166	BNC to TB84PH Pin Adapter w/ ½" Liquid-Tite Fitting For Sensors w/ BNC (i.e., TB5 Sensors)

APPENDIX A - TEMPERATURE COMPENSATION

GENERAL

The TB84PH Advantage Series analyzer has three types of temperature compensation options. These include Manual Nernstian, Automatic Nernstian, and Automatic Nernstian with Solution Coefficient.

The effect of temperature on ORP and pION sensors is difficult to characterize, except for specific applications. For these reasons, only the Solution Coefficient option can be used to temperature compensate for electrode and/or process effects.

NERNSTIAN TEMPERATURE COMPENSATION

Manual and Automatic Nernstian Temperature Compensation adjusts for the thermodynamic properties of electrochemical half cells. The Nernstian effect is characterized by the mathematical equation:

$$E = E_{Reference} + \frac{2.3 * R * T_K LOG[a_i]}{n * F}$$

where:

E	=	Overall Sensor Output.
$E_{Reference}$	=	Reference Half Cell Output (typically a constant).
R	=	Constant
T_K	=	Absolute Temperature (Kelvin).
n	=	Ion Charge.
F	=	Constant.
$[a_i]$	=	Ion Activity.

Since the ion activity (i.e., $[a_i]$)is nearly equal to the ion concentration for weak solutions, the Nernst Equation can be used to convert the sensor output into pH values for pH sensors and concentration values for pION sensors.

Temperature effects on pION and ORP sensors are not easily characterized; therefore, the Nerstian relationship is not used on these types of sensors. Conversely, pH sensors are well behaved and can be characterized by this Nernst Equation.

The TB84PH Advantage Series analyzer applies Nernstian compensation to all three pH temperature compensation options. If the user is interested in the uncompensated value, setting the TB84PH Advantage Series analyzer to Manual and calibrating the temperature to 25°C will allow them to monitor the uncompensated value. Automatic Nernstian (AUTO) provides the most useful information and is recommended in most cases.

Since ion dissociation is affected by temperature, the pH value can be also affected. If these processes behave in a repeatable manner, the dissociation can be characterized and a Solution Coefficient can be used to compensate for these effects.

SOLUTION COEFFICIENT

The solution coefficient compensates the Nernstian value, in the case of pH, and the raw voltage value, in the case of ORP or pION. The coefficient is applied as a fixed value per each 10°C away from 25°C. The temperature compensation factor is derived from the following equations:

$$pH_{Indication} = pH_{Nerstian} \pm COEF * ((T - 25°C)/10°C)$$

$$mV_{Indication} = mV \pm COEF * ((T - 25°C)/10°C)$$

where:

COEF	=	pH or mV change per 10 degrees Celsius.
$pH_{Nernstian}$	=	Nernstian pH Value referenced at 25°C after applying the factory and process calibration values.
$pH_{Indication}$	=	pH Value indicated on the analyzer.
mV	=	mV Value of the sensor output after applying the factory and process calibration values.
$mV_{Indication}$	=	mV Value indicated on the

analyzer.

T = Temperature of the solution in °C after applying the factory and process calibration values.

For example, solution coefficients for pure water applications are:

Pure Water = +0.18 pH/10°C
Pure Water w/ 1ppm Ammonia = +0.31 pH/10°C

For the TB84PH Advantage Series analyzer, the solution coefficient will either add (+) or subtract (-) a configured amount of the process variable per 10°C to the Nernstian compensated process variable. Thus, an application having a process liquid that decreases in its pH value as the temperature increases should use a positive (+) solution coefficient correction factor. Conversely, an application having a process liquid that increases in its pH value as the temperature increases should use a negative (-) solution coefficient correction factor. For ORP and pION analyzer types, the solution coefficient adjusts the uncompensated process variable and does not use the Nerstian relationship.

APPENDIX B - PROGRAMMING TEXT STRING GLOSSARY

GENERAL

When programming the TB84PH Advantage Series analyzer, the six digit, alphanumeric region will display a wide variety of text prompts. In many cases, these prompts are abbreviations or portions of words. This section contains a complete list of the text prompts and their full text equivalent.

GLOSSARY OF PROGRAMMING TEXT PROMPTS

Table B-1. Glossary of Text Prompts

TEXT STRING	DESCRIPTION
1PT.CAL	One Point Calibration
20MA.PT	20 Milliamp Point
2PT.CAL	Two Point Calibration
3K.BLCO	3 kohm Balco (Temperature Compensation)
4MA.PT	4 Milliamp Point
REV.A10	Software Revision A10
ADVNCD	Advanced (Programming Mode)
ANALZR	Analyzer State
ANTMNY	Antimony (pH Sensor with Antimony Measurement Electrode)
ASY.POT	Asymmetric Potential
AUT.SOL	Automatic Temperature Compensation (Nernstian) with Solution Coefficient
AUTO	Automatic Temperature Compensation (Nernstian)
BAD.CAL	Bad Calibration - Entered values caused the calculated values to exceed maximum values.
BAD.VAL	Bad Value - Entered value exceeded maximum allowable value for the entered parameter.
CALIBR	Calibrate Mode
CONFIG	Configure Mode
DAMPNG	Damping State
DIAGS	Diagnostics State

TEXT STRING	DESCRIPTION
DISABL	Disable
END.MV	Ending Millivolt Point (For Specific Ion Concentration configuration only).
END.MAG	Ending Magnitude Point (For Specific Ion Concentration configuration only).
FAIL.HI	Fail High (i.e., 20 mA)
FAIL.LO	Fail Low (i.e., 4 mA)
HI.VAL	High Calibration (Buffer or Standard) Value
ION.CAL	Specific Ion Calibration
ION.CON	Specific Ion Concentration
ISO.PT	Isopotential Point
---KRZ	Reference Impedance in kohms where --- is the impedance value.
LO.VAL	Low Calibration (Buffer or Standard) Value
MAGS	Magnitudes - Number of decades the output range will cover (For Specific Ion Concentration configuration only).
MV/10C	Millivolt per 10°C (Solution Coefficient value for Automatic Nernstian with Solution Coefficient Temperature Compensation)
NEW.VAL	New Calibration Value - The PV or Temperature value expected during a One Point or Temperature Calibration.
NON.LIN	Non-Linear Output State
ORP.CAL	ORP Calibration State
OUT.CAL	Output Calibration State
PASSWD	Security Password
PH.CAL	pH Calibration State
PH.GLAS	pH Glass (pH Sensor with Glass Measurement Electrode)
PT 100	Pt100 Ohm RTD
REF Z	Reference Impedance
REL.HLD	Release Hold

TEXT STRING	DESCRIPTION
RERANG	Rerange State
RST.ALL	Reset All Parameters to Factory Settings
RST.CAL	Reset Calibration Constant and Data to Factory Settings
RST.CON	Reset Configurations to Factory Defaults
RST.SEC	Reset Security - Remove any existing security.
SAFE.MD	Safe Mode State
SEC.DSP	Secondary Display Mode
SECS	Seconds
SECUR	Security Mode
SPK.MAG	Spike Output Magnitude
SPK.OFF	Spike Output Function set to Off (i.e., Disable)
STABL?	Is the displayed Process Variable Stable?
TC.TYPE	Temperature Compensation Type State
TMP.CAL	Temperature Calibration State
TMP.SNS	Temperature Sensor Type State
TMP°C	Temperature in degrees Celsius
VALENC	Ion Valence State (For Specific Ion Concentration configuration only).
X-1	Nonlinear X Input Point value for Breakpoint 1 in percentage of input.
Y-1	Nonlinear Y Output Point value for Breakpoint 1 in percentage of output.

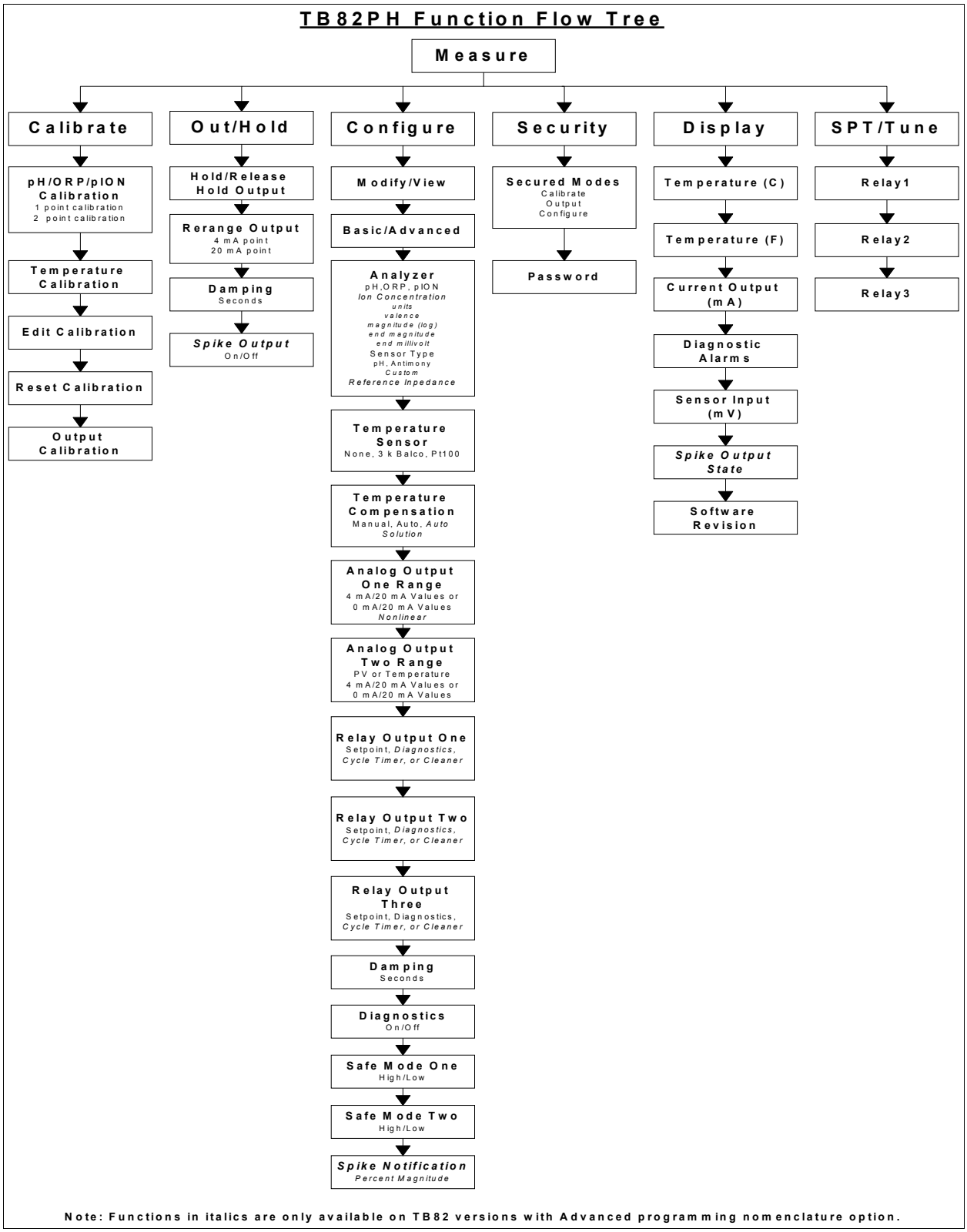


Figure B-1. TB84PH Programming Function Flow Chart.

APPENDIX C - CONFIGURATION WORKSHEETS

TB84PH ADVANTAGE SERIES WORKSHEET

Tag: | Date:

Programming Mode: ☐ Basic ☐ Advanced

Analyzer Type:

☐ pH	☐ ORP	☐ pION	☐ Ion Conc.
☐ GLASS ☐ ANTIMONY ☐ CUSTOM ISO PT: _____ pH ASY POT: _____ mV REF Z: _____ kohm	REF Z: ___ kohm	REF Z: ___ kohm	UNIT: _____ VALENCE: _____ MAGS: _____ END MAG: _____ END MV: _____ mV REF Z: _____ kohm

Temperature Sensor: ☐ None ☐ 3k Balco ☐ Pt100

Temperature Compensation Type: ☐ Manual ☐ Auto ☐ Auto Solution
Coeff.: _____

Analog Output One Range (AO1):
0 mA: _____ 4 mA: _____ 20 mA: _____
☐ Linear
☐ Non-linear

X-1 _____	Y-1 _____
X-2 _____	Y-2 _____
X-3 _____	Y-3 _____
X-4 _____	Y-4 _____
X-5 _____	Y-5 _____
X-6 _____	Y-6 _____

Analog Output Two Range (AO2):
☐ PV ☐ Temperature °C ☐ Temperature °F
0 mA: _____ 4 mA: _____ 20 mA: _____

Relay Output One (R01):

☐ Setpoint	☐ Diagnostics	☐ Cycle Timer	☐ Cleaner
☐ High ☐ Low ☐ PV ☐ Temp. °C ☐ Temp. °F Setpoint: _____ Deadband: _____ Delay(min): _____	☐ All ☐ Sensor ☐ Instrument	☐ High ☐ Low Setpoint: _____ Cycle(min): _____ On(min): _____	Setpoint: _____ Cycle(min): _____ On(min): _____ ☐ Hold AO's ☐ Hold RO's ☐ Disable RO's

Relay Output Two (RO2):

☐ Setpoint	☐ Diagnostics	☐ Cycle Timer	☐ Cleaner
☐ High ☐ Low ☐ PV ☐ Temp. °C ☐ Temp. °F Setpoint: _____ Deadband: _____ Delay(min): _____	☐ All ☐ Sensor ☐ Instrument	☐ High ☐ Low Setpoint: _____ Cycle(min): _____ On(min): _____	Setpoint: _____ Cycle(min): _____ On(min): _____ ☐ Hold AO's ☐ Hold RO's ☐ Disable RO's

Relay Output Three (RO3):

☐ Setpoint ☐ High ☐ Low ☐ PV ☐ Temp. °C ☐ Temp. °F Setpoint: _____ Deadband: _____ Delay(min): _____	☐ Diagnostics ☐ All ☐ Sensor ☐ Instrument	☐ Cycle Timer ☐ High ☐ Low Setpoint: _____ Cycle(min): _____ On(min): _____	☐ Cleaner Setpoint: _____ Cycle(min): _____ On(min): _____ ☐ Hold AO's ☐ Hold RO's ☐ Disable RO's

Damping Value: _____ Seconds	_____ Display (Seconds) _____ AO1 (Seconds) _____ AO2 (Seconds)
Diagnostics: ☐ Enabled	☐ Disabled
Safe Mode One Level: ☐ Fail Low	☐ Fail High
Safe Mode Two Level: ☐ Fail Low	☐ Fail High
Spike Magnitude: _____ %	
Security: ☐ Configure ☐ Calibrate ☐ Output/Hold Password: _____	

Factory Default Settings

Software		Hardware
Instrument Mode:	Basic	Microprocessor/Display PCB W1 (Configuration Lockout):[2] 1-2, Disable Lockout[3] 2-3, Enable Lockout
Analyzer Type:	pH, Glass	
Temperature Sensor Type:	3k, Balco	
Temperature Compensation Type:	Manual	
Analog Output One Range:	0 to 14 pH	
Analog Output Two Range:	0 to 140°C	
Relay Output One High Setpoint Value: Deadband: Delay:	14.00 pH 0.10 pH 0.0 mins	
Relay Output Two High Setpoint Value: Deadband: Delay:	14.00 pH 0.10 pH 0.0 mins	
Relay Output Three Diagnostics:	Instrument	
Damping Value:	0.5 Seconds	[1] Feature available only in Advanced programming. [2] See Figure 8-3 for jumper location. [3] Bold text indicates default hardware settings.
Sensor Diagnostics State:	Off (Disabled)	
Safety Mode One Failed Output State:	Low	
Safety Mode Two Failed Output State:	Low	
Spike Output[1] Level:	0%	

Products and customer support

Automation Systems
For the following industries:
- Chemical & Pharmaceutical
- Food & Beverage
- Manufacturing
- Metals and Minerals
- Oil, Gas & Petrochemical
- Pulp and Paper

Drives and Motors
- AC and DC Drives, AC and DC Machines, AC Motors to 1kV
- Drive Systems
- Force Measurement
- Servo Drives

Controllers & Recorders
- Single and Multi-loop Controllers
- Circular Chart and Strip Chart Recorders
- Paperless Recorders
- Process Indicators

Flexible Automation
- Industrial Robots and Robot Systems

Flow Measurement
- Electromagnetic Flowmeters
- Mass Flowmeters
- Turbine Flowmeters
- Wedge Flow Elements

Marine Systems & Turbochargers
- Electrical Systems
- Marine Equipment
- Offshore Retrofit and Refurbishment

Process Analytics
- Process Gas Analysis
- Systems Integration

Transmitters
- Pressure
- Temperature
- Level
- Interface Modules

Valves, Actuators and Positioners
- Control Valves
- Actuators
- Positioners

Water, Gas & Industrial Analytics Instrumentation
- pH, Conductivity and Dissolved Oxygen Transmitters and Sensors
- Ammonia, Nitrate, Phosphate, Silica, Sodium, Chloride, Fluoride, Dissolved Oxygen and Hydrazine Analyzers
- Zirconia Oxygen Analyzers, Katharometers, Hydrogen Purity and Purge-gas Monitors, Thermal Conductivity

Customer support
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Fax: +44 (0)1453 829671

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ABB Engineering (Shanghai) Limited
Tel: +86 (0) 21 6105 6666
Fax: +86 (0) 21 6105 6992

Client Warranty
Prior to installation, the equipment referred to in this manual must be stored in a clean, dry environment, in accordance with the Company's published specification. Periodic checks must be made on the equipment's condition. In the event of a failure under warranty, the following documentation must be provided as substantiation:
- A listing evidencing process operation and alarm logs at time of failure.
- Copies of all storage, installation, operating and maintenance records relating to the alleged faulty unit.

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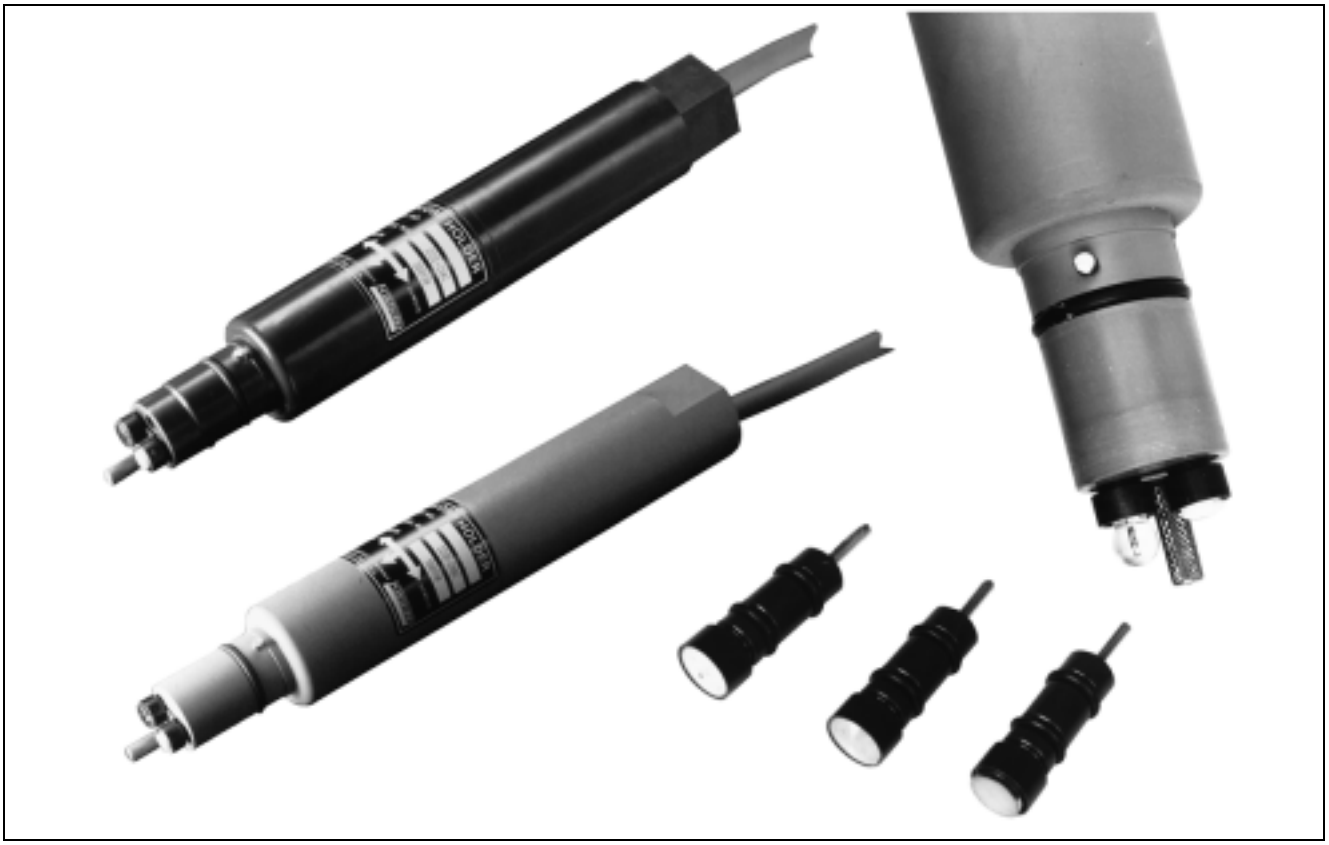
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Power and productivity
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871PH Series
pH, ORP, and Fluoride Sensors and Accessories



871PH multi-purpose precision electrochemical sensors, used in conjunction with 871PH accessories, are suitable for pH, ORP, and Fluoride measurement applications. As symbolized by the “CE” marking, these Sensors conform to the European Union directive.

These sensors are used with 873 Electrochemical Analyzers, 870ITPH Intelligent Transmitters, and 870PH Analog Transmitters. Measurement of pH by the Foxboro 871PH Sensors is accomplished by immersing a glass or metal electrode, with a reference electrode, into a process solution. The glass or metal electrode produces an electrical potential proportional to the hydrogen ion activity. The reference electrode completes the circuit and provides a stable reference for the glass or metal electrode. These two electrodes constitute an electrolytic cell having a millivolt output that is proportional to the pH of the solution.

ORP is related to the logarithm of the ratio of oxidation activity to reduction activity, just as pH is related to the logarithm of the hydrogen ion activity. A solution that contains an excess of oxidizing agent has a positive ORP while one containing an excess of reducing agent has a negative ORP.

Typical ORP applications include treatment of chromate and cyanide wastes produced by plating, chemical, and metal treatment plants. ORP monitoring enables industry to determine reaction end points and to meet today's stringent environmental requirements.

Fluoride measurement is accomplished by means of an ion-selective electrode, or ISE. A pH electrode is an example of an ISE which is sensitive to hydrogen ion activity. Similarly, the fluoride electrode utilizes a lanthanum fluoride crystal which is sensitive to fluoride ion activity. When immersed in a solution containing free fluoride ions, the electrode develops a millivolt potential proportional to the ion activity. Typical fluoride applications include control and monitoring of fluoridation of drinking water supplies.

SINGLE MULTI-PURPOSE ASSEMBLY

This multi-purpose sensor assembly is suitable for virtually all process pH, ORP, and fluoride measurement applications. Its flexibility is further enhanced when used with a variety of mounting accessories. The sensor accepts a variety of glass pH, metallic pH, and ORP electrodes, as well as a new ion-selective electrode for fluoride measurement. The unit is not affected by normally encountered chemical solutions and is capable of withstanding continuous operation in a wide range of process pressures and temperatures.

CHOICE OF SENSOR BODY

The sensor assembly is available in either a Ryton or CPVC body. The Ryton body can be used in almost any normally encountered chemical solution, and is the preferred material where organic chemicals are present. The CPVC body is used in applications involving hypochlorites or peroxides (e.g., bleach).

CHOICE OF SENSING ELECTRODES

Glass pH electrodes offer the best performance in most solutions and inherently provide the most accurate measurement. The flat ruggedized electrode or the small bulb results in a durable electrode suitable for industrial service.

The flat, ruggedized glass electrode with a Ryton body is recommended for most pH measurements because of its very durable, abrasion-resistant construction. This electrode is particularly resistant to wear, stress, and abuse caused by physical operating conditions. Its optimum accuracy is in the range of 2 to 12 pH, although it can be used with Analyzers and Transmitters that are ranged from 0 to 14 pH.

The spherical glass, low sodium error electrode with a Ryton body is recommended for applications where the pH is routinely in the range of 10 to 14 pH. It features a glass formulation with minimal sodium ion error. It should also be selected for applications in low conductivity water (down to 10µS/cm).

Metallic (antimony) pH electrodes are available for abrasive solutions or for solutions containing hydrofluoric acid or other chemicals which attack glass. Antimony electrodes should not be used in acid copper solutions nor in oxidizing or reducing solutions such as chromates, chlorine, hypochlorites, or sulfides.

Platinum or gold ORP electrodes are also available. (Gold is primarily used in cyanide reduction systems.)

The newest addition to the 871PH's electrode offering is an ion-selective electrode for the measurement of ppm fluoride. The fluoride electrode consists of a lanthanum fluoride crystal in an epoxy body, and is compatible with the 873DPX Analyzer and 870ITPH Transmitter.

SENSOR DIAGNOSTICS

When used with the Foxboro 870ITPH Intelligent Transmitter, the intelligent configurations of the sensor (Model Code Sensor Selections “–3”, “–4”, “–5”, and “–6”) provide diagnostic information. Sensor health checks will reveal the following faults:

- Broken Glass Electrode
- Aging Glass Electrode
- Liquid Leakage into Sensor Body
- Failure of High Impedance Amplifier in Sensor (Sensor Selection Codes “–3” and “–4” only)
- Failure of Temperature Compensation Element
- Excessive Coating of the Reference Electrode

FIELD INTERCHANGEABLE ELECTRODES

Interchangeable plug-in sensing electrodes are available to suit most applications. All electrodes are compatible with the same basic sensor body. If the measurement conditions or application needs change, it is simple to change from one measurement electrode to another in the field.

FIELD REPLACEABLE REFERENCE JUNCTION

The reference electrode is a nonflowing type. A silver/silver chloride half cell immersed in saturated potassium chloride is used because of its highly stable output voltage. The filling solution and the ceramic junction may be readily replaced in the field. See Model Code section for choice of body material.

INTEGRAL PREAMPLIFIER

An integral preamplifier (Model Code Sensor Selections “–1” through “–4”) converts the high impedance pH signal to a low impedance signal, which is less prone to interference.

MOUNTING VERSATILITY

The basic sensor assembly may be mounted:

- In-line via Ball Valve Assembly
- In a sample line via Twist-Lock Flow Chambers
- In-line via Twist-Lock Bushings or Tees
- In-situ via Electrode Protection Sleeve

See Physical Specifications section for additional information.

INTEGRAL AUTOMATIC TEMPERATURE COMPENSATION

Automatic temperature compensation (ATC), utilizing a platinum resistance temperature detector (RTD), is a built-in feature in the 871PH Sensor.

VARIETY OF ACCESSORIES

A variety of process mounting accessories offers a versatile selection to meet virtually all process requirements (see Accessories section).

PERFORMANCE SPECIFICATION

Reproducibility

Typically ±2 mV dc (0.03 pH unit) at reference conditions. Reproducibility at operating conditions depends on calibration standard used, cleanliness of electrode, and other process-related conditions.

Optional Foxboro electrode cleaners aid in maintaining a high degree of reproducibility on pH and ORP electrodes in dirty process streams. (See PSS 6-1A2 C on Model ECS Electrode Cleaning Systems.)

PRESSURE AND TEMPERATURE SPECIFICATIONS

NOTE

Maximum allowable temperature and pressure may be limited by installation hardware utilized. Refer also to the temperature and pressure specifications on all appropriate bushings, tees, flow chambers, and ball valve assemblies.

Ryton Body

Measuring Electrode Type	Ball Valve or Submersible Installation		In-Line Installation	
	Maximum Pressure	Temperature Range	Maximum Pressure	Temperature Range
Flat Glass pH	1 MPa (150 psi)	–5 to + 80°C (20 to 175°F)	1 MPa (150 psi)	–5 to +105°C (20 to 220°F)
Spherical Glass pH	0.7 MPa (100 psi)	–5 to + 80°C (20 to 175°F)	0.7 MPa (100 psi)	–5 to +105°C (20 to 220°F)
Antimony pH	1 MPa (150 psi)	–5 to + 80°C (20 to 175°F)	1 MPa (150 psi)	–5 to +125°C (20 to 255°F)
ORP	1 MPa (150 psi)	–5 to + 80°C (20 to 175°F)	1 MPa (150 psi)	–5 to +125°C (20 to 255°F)
Fluoride ISE	0.7 MPa (100 psi)	–5 to + 60°C (20 to 140°F)	0.7 MPa (100 psi)	–5 to +60°C (20 to 140°F)

CPVC Body

Measuring Electrode Type	Ball Valve or Submersible Installation			In-Line Installation		
	Maximum Pressure at Operating Temperature			Maximum Pressure at Operating Temperature		
Flat Glass pH Spherical Glass pH(a) Antimony pH ORP Fluoride ISE(b)	0.9 MPa (125 psi) at –5°C (20°F)	0.6 MPa (90 psi) at 50°C (120°F)	0.3 MPa (50 psi) at 80°C (175°F)	0.9 MPa (125 psi) at –5°C (20°F)	0.3 MPa (50 psi) at 80°C (175°F)	0.1 MPa (15 psi) at 100°C (212°F)

(a)Maximum Pressure at –5°C (20°F) for Spherical Glass pH electrode is 0.7 MPa (100 psi).
(b)Maximum operating temperature of Fluoride ISE is 60°C (140°F). Maximum pressure at –5°C (20°F) is 0.7 MPa (100 psi).

MODEL CODE

Description	Model
pH/ORP/ISE Sensor	871PH
Sensor Body Material and Diagnostic Configuration	
(See Sensor/Analyzer/Transmitter Compatibility Table on Next Page)	
Ryton, Standard Configuration, Integral Preamplifier	–1
CPVC, Standard Configuration, Integral Preamplifier	–2
Ryton, Intelligent Configuration, Integral Preamplifier(a)	–3
CPVC, Intelligent Configuration, Integral Preamplifier(a)	–4
Ryton, Intelligent Configuration, No Preamplifier(a)	–5
CPVC, Intelligent Configuration, No Preamplifier(a)	–6
Measuring Electrode and (Body Material)	
pH, Spherical Glass (Ryton)	A
pH, Antimony (Ryton)	B
ORP, Platinum (Ryton)	D
ORP, Gold (Ryton)	E
pH, Flat Glass (Ryton)(b)	F
Fluoride, Lanthanum Fluoride (Epoxy) – Must Select Ref. Junction/Body Mat'l Code “C”	L
pH, Spherical Glass (ptfe)	P
ORP, Platinum (ctfe)	R
None	X
Sensor Wetted Metallic Parts Material	
Titanium	1
Carpenter 20 Cb-3	2
316L Stainless Steel (ss)	3
Monel 400	5
Tantalum	6
Reference Junction and Body Material	
Ceramic, Ryton	A
Ceramic, ptfe	B
Ceramic, Epoxy – Required Selection when using Measuring Electrode Code “L”	C
Optional Selections(c)	
Nonstandard Length Integral Cable, Specify Length(d)	–3
No Spade Lug Terminals(e)	–4
Nonstandard Length Integral Cable Terminated in Connector, Specify Length Select with 871PH-1 or -2 Only(d,f,g)	–5
Standard Length Integral Cable Terminated in Connector Select with 871PH-1 or -2 Only(d,f,g)	–7
Example: 871PH–1F1A–4	

(a) Compatible with 870ITPH Intelligent Transmitter only.
(b) Optimum accuracy is in the range of 2 to 12 pH. It can, however, be used with pH instruments ranged from 0 to 14 pH.
(c) Except for the possible combination “–34”, only one optional selection may be chosen. Optional selections “–3” and “–4” may each be selected individually or as a combination.
(d) Standard cable length if not specified = 6 m (20 ft).
(e) Optional Selection Code “–4” required when sensor is used with 873PH Series Analyzers.
(f) Requires Patch Cable.
(g) Not compatible with ball valve assembly mountings.

NOTE

See Sensor/Analyzer/Transmitter Compatibility Table on next page.

Sensor/Analyzer/Transmitter Compatibility Table

Instrument	Sensor Connection at Instrument	Sensor Body Material/Diagnostic Configuration Code					
		871PH-1	**871PH-2**	**871PH-3**	**871PH-4**	**871PH-5**	**871PH-6**
873PH Analyzer	Stripped and Tinned Leads	X 150 m (500 ft) maximum	X 150 m (500 ft) maximum	N/A	N/A	N/A	N/A
873DPX Analyzer	• Sensor with Integral Preamp. No. 6 Spade Terminals • Sensor wo/Integral Preamp. Stripped and Tinned Leads	X 150 m (500 ft) maximum	X 150 m (500 ft) maximum	N/A	N/A	N/A	N/A
870ITPH Intelligent Transmitter	No. 6 Spade Terminals	N/A	N/A	X 150 m (500 ft) maximum	X 150 m (500 ft) maximum	X 15 m (50 ft) maximum	X 15 m (50 ft) maximum
870PH Analog Transmitter	No. 6 Spade Terminals	X 30 m (100 ft) maximum	X 30 m (100 ft) maximum	N/A	N/A	N/A	N/A

Notes: 1. N/A = Not Applicable (not compatible)
2. X = Sensor/Instrument compatibility and maximum allowable cable length between instrument and sensor is given.

ELECTRICAL SAFETY SPECIFICATIONS

Testing Laboratory, Types of Protection, and Area Classification	Application Conditions	Electrical Safety Design Code
BASEEFA intrinsically safe EEx ia, IIC (CENELEC). Suitable for use in Zone 0 or Zone 1, or in Zone 1 only, according to whether power source is certified ia or ib, respectively.	Connect to 870 Series Transmitters. Safety parameters are: V_{max} = 30 V; I_{max} = 322 mA; and P_{max} = 1.2 W. Temperature Class T6.	CS–E/BA–E
FM intrinsically safe for Class I, Division 1, Groups A, B, C, and D; and Class II, Division 1, Groups E and G, hazardous locations.	Connect to 870 Series Transmitters per TI 005-101. Temperature Class T6.	CS–E/FB–A

NOTE

These sensors have been designed to meet the electrical safety descriptions listed in the table above. For detailed information, or status of testing laboratory approvals, or certifications, contact Foxboro.

FUNCTIONAL SPECIFICATIONS

Reference Electrode
Nonflowing type

Sensor Assembly Immersion/Submersion Depth
50 mm (2 in) minimum
6 m (20 ft) maximum

Automatic Temperature Compensation
FOR STANDARD CONFIGURATION SENSORS
2-wire platinum RTD, 100 Ω
FOR INTELLIGENT CONFIGURATION SENSORS
871PH-3, -4 Versions
3-wire platinum RTD, 1000 Ω
871PH-5, -6 Versions
2-wire platinum RTD, 1000 Ω

ATC Temperature Limits
–5 and +125°C (20 and 255°F)

Cable Length
See table below

Cable Selection	Cable Length	
	With Preamplifier	Without Preamplifier
Standard	6 m (20 ft)(a)	6 m (20 ft)(a)
Optional	150 m (500 ft)(b) maximum	15 m (50 ft)(c) maximum

(a) Cable is integral with sensor assembly.
(b) Integral cable to 15 m (50 ft). For cable lengths beyond 15 m (50 ft), an extension cable is required.
(c) Integral or extension cable to a maximum total length of 15 m (50 ft).

PHYSICAL SPECIFICATIONS

Sensor Mountings

Type	Description
In-Line via Ball Valve Unit Assembly (Figure 1A)	Permits sensor to be removed from process stream or tank, under rated temperature and pressure, without draining the system or resorting to a bypass arrangement.
Sample Line Twist-Lock Flow Chamber (Figure 1B)	Available for clean sample stream applications. A 316 ss flow chamber is recommended for pure water pH measurement.
In-Line via Twist-Lock Bushing (Figure 1C)	For permanent installation in pipeline or tank.
In-Line via Twist-Lock Tee (Figure 1D)	For permanent installation in pipeline.
In-situ (Figure 1E)	In tank or trough, etc. An electrode protection sleeve is required for this use.

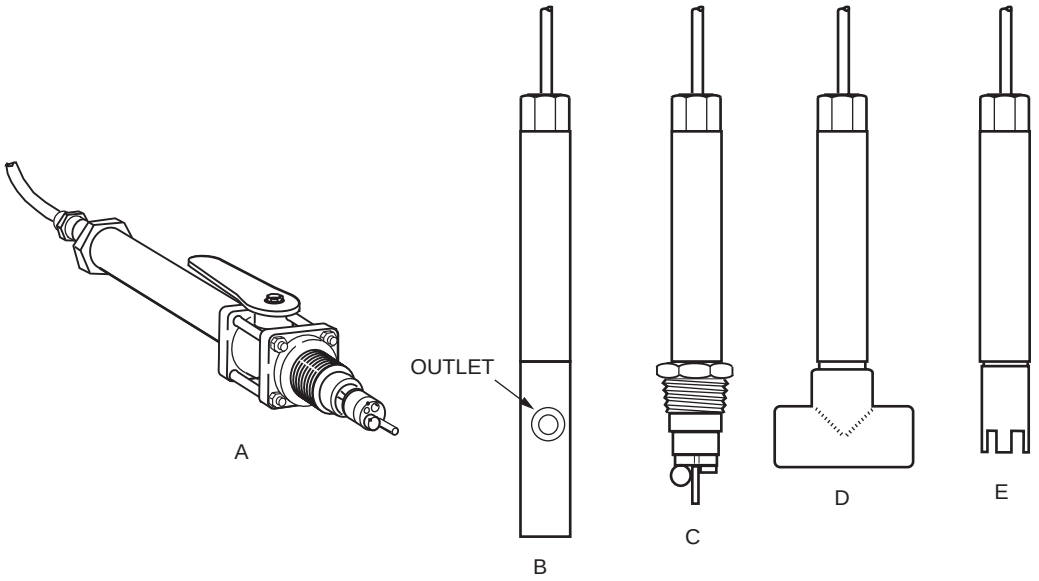


Figure 1. Sensor Mountings

PHYSICAL SPECIFICATIONS (Cont.)

Measuring Electrodes
Plug-in, interchangeable.

Reference Electrode
Nonflowing, with Ag/AgCl internals and saturated potassium chloride (KCl) electrolyte.
REFERENCE JUNCTION
Ceramic
BODY MATERIAL
Ryton, ptfe, or Epoxy
O-RINGS
Viton

Wetted Parts
Ryton or CPVC housing and Viton O-ring. For electrodes and solution ground, see Model Code on Page 4.

Cable
Integral, 6 m (20 ft), screened PVC-jacketed cable, terminated in numbered spade terminals for connection to 870ITPH or 870PH Transmitters or 873DPX Analyzer. Optional lugless terminations are available for use with 873PH Analyzer.

Material of Construction
GLASS PH
{Employing high stability silver, silver chloride (Ag/AgCl) internals} Ryton or ptfe body for spherical glass electrodes, and Ryton body for flat ruggedized glass electrodes.
ANTIMONY PH
Ryton body
PLATINUM ORP
Ryton or ctfe body
GOLD ORP
Ryton body
FLUORIDE ISE
Epoxy body
O-RINGS
Viton

Solution Ground
Titanium, Carpenter 20 Cb-3, 316L Stainless Steel, Monel 400, or Tantalum, as specified. Solution ground acts as a keeper for securing electrodes in the assembly.

ACCESSORIES

Accessory Selection for Parts Common to all Sensors (See Next Page for Parts which vary with Sensor)

Part Description	Select Foxboro Part
Complete Ball Valve Assembly	
For AISI Type 316 stainless steel (316 ss) Process Connection and Housing	
With nonpurgeable housing	BS805JN(a)
With purgeable housing	BS805JP(b)
For Titanium Process Connection and Housing	
With purgeable housing	BS805JQ(c)
Flow Chamber (See Table 2 for rated pressure and temperature)	
PVC	0051181
316 ss	0051179
Bushing (See Table 3 for rated pressure and temperature)	
PVC	
1 1/4 NPT	0051183
316 ss	
1 1/4 NPT	0051185
1 1/2 NPT	0051186
Plug (See Table 4 for rated pressure and temperature)	
PVC	0051187
316 ss	0051188
PVC Tee (See Table 5 for rated pressure and temperature)	0051184
CPVC Submersion Adaptor with Viton O-Ring	BS805PU(d)
PVC Electrode Protection Sleeve	0051189
Buffers	(see Table 6)
Electrode and Reference Kits	(See Table 7 and Table 8)

(a)Previously specified as Part Number 0051361 plus 0051362 (shaft assembly).
(b)Previously specified as Part Number 0051380 plus 0051362 (shaft assembly).
(c)Previously specified as Part Number 0051360 plus 0051365 (shaft assembly).
(d)Supplied as standard on models dated Aug. 1987 to Dec. 1988. Not required on sensors dated on or later than Jan. 1989.

ACCESSORIES (Cont.)

Accessory Selection for Parts which Vary with Sensor Selection

Part Description	Select Foxboro Part for Sensors		
	871PH–1,2	871PH–3,4	871PH–5,6
Junction Box IEC IP65 and NEMA 4 specifications, watertight fittings	0051052	BS807BZ	Q0101CF
Extension Cable Assembly with Spade Terminals Specify length up to 150 m (500 ft)	0060301	BS807CK	BS805SK
Extension Cable without Spade Terminals Specify length up to 330 m (1000 ft)	6000–130	P0170RG	P0170LF
Patch Cable, Standard Length, 3 m (10 ft)	BS806NP	N/A	N/A
Patch Cable, Length to Sales Order up to 33 m (100 ft)	BS806NQ	N/A	N/A

Ball Valve Assemblies

The ball valve assembly (Figure 2) permits a sensor assembly to be inserted and removed from a process stream or tank under rated temperature and pressure without draining the system or resorting to a bypass arrangement. A ball valve assembly consists of the ball valve unit and an insertion shaft assembly; both support a sensor in a stream. A standard flexible conduit (user provided) can be used for cable protection. For additional information, refer to Table 1.

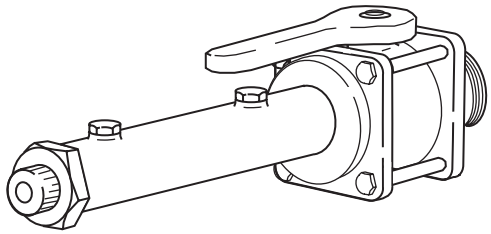


Figure 2. Purgeable Ball Valve Assembly (Foxboro Part BS805JP Illustrated)

Table 1. Ball Valve Assembly Specifications

Process Line Connection (in)	Rated Pressure		Maximum Temperature at Rated Pressure		Material of Process Wetted Parts(a)				Foxboro Part Number	
	MPa	psi	°C	°F	Process Connection and Housing	Ball Seat	Ball Valve	O-Ring	Purgeable Housing	Non-purgeable Housing
1 1/2 NPT	1.0	145	20	70	316 ss	ptfe	Glass-filled poly-propylene	Viton	BS805JP (b)	BS805JN (c)
	0.4	55	65	150						
	0.07	10	88	190						
1 1/2 NPT	1	145	60	140	Titanium	ptfe	Kynar	Viton	BS805JQ (d)	N/A
	0.6	85	100	212						
	0.4	60	120	250						

(a)Refer to Foxboro for other materials.
(b)Previously specified as Part Number 0051380 plus 0051362 (shaft assembly).
(c)Previously specified as Part Number 0051361 plus 0051362 (shaft assembly).
(d)Previously specified as Part Number 0051360 plus 0051365 (shaft assembly).

ACCESSORIES (Cont.)

Flow Chambers

Flow chambers (Figure 3) are a convenient way of mounting sensors in a system where a sample is provided by small diameter sample line. The flow chamber connects to the system via user supplied 1/4 NPT fittings, and provides a chamber for the sample. A flow chamber with sensor in place, will pass up to 125 mL/s (2 gpm) of sample (see Table 2 for specifications).



Figure 3. Flow Chamber
(Foxboro Part 0051179 Illustrated)

Table 2. Flow Chamber Specifications

Material	Rated Pressure at Rated Temperature				Foxboro Part
	MPa	psi	°C	°F	
PVC	0.4	60	50	120	0051181
	0.2	30	60	140	
316 ss	1.4	200	125	260	0051179

Bushings

Bushings (Figure 4) may be used to mount sensors in a system using process piping larger than DN 20 or 3/4 in piping. A Twist-Lock connection secures the sensor into the bushing (see Table 3 for specifications).



Figure 4. Bushing
(Foxboro Part 0051185 Illustrated)

Table 3. Bushing Specifications

Mat'l	Thread Size (NPT)	Rated Pressure at Rated Temperature				Foxboro Part
		MPa	psi	°C	°F	
PVC	1 1/4	0.4	60	50	120	0051183
		0.2	30	60	140	
316 ss	1 1/4	1.4	200	125	260	0051185
	1 1/2					0051186

Plugs

A plug (Figure 5) replaces a sensor to provide system sealing (if a sensor is removed from the process for maintenance, cleaning, etc). The plug is compatible with any Foxboro Twist-Lock receptacle (e.g., flow chamber, bushing, tee, etc.) (see Table 4 for specifications).



Figure 5. Plug (Foxboro Part 0051188 Illustrated)

Table 4. Plug Specifications

Material	Rated Pressure at Rated Temperature				Foxboro Part
	MPa	psi	°C	°F	
PVC	0.4	60	50	120	0051187
	0.2	30	60	140	
316 ss	1.4	200	125	260	0051188

ACCESSORIES (Cont.)

Tee

A solvent weld DN 25 or 1 in PVC tee (Figure 6) is available for insertion in a pipeline. Mating to a sensor is achieved via a Twist-Lock connection (see Table 5 for specifications).



Figure 6. Tee
(Foxboro Part 0051184 Illustrated)

Table 5. Tee Specifications

Mat'l	Rated Pressure at Rated Temperature				Nominal Length		Foxboro Part
	MPa	psi	°C	°F	mm	in	
PVC	0.4	60	50	120	95	3.8	0051184
	0.2	30	60	140			

Submersion Adaptor

For older sensors, a submersion adaptor (Figure 7) is required in applications where the cable end of the sensor is wetted by the process (e.g., submersion or ball valve assembly applications).

The adaptor is made of CPVC. One end of the adaptor threads into the cable end of the sensor and is provided with a Viton O-ring seal. The other end is threaded for 1/2 in conduit and has an RTV seal plug.

Maximum temperature rating is 120°C (250°F).

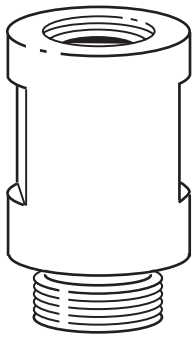


Figure 7. Submersion Adaptor
(Foxboro Part BS805PU)

Electrode Protection Sleeve

The electrode protection sleeve (Foxboro Part 0051189), Figure 8, protects glass electrodes from contacting the bottom or side of a tank. This PVC sleeve (with a maximum temperature rating of 60°C {140°F}) is available for submersible or ball valve assembly applications.



Figure 8. Electrode Protection Sleeve
(Foxboro Part 0051189)

Junction Box

The junction box (Figure 9) provides for connecting the sensor assembly cable to the extension cable (see Extension Cable Assembly section). The surface-mounted junction box is weatherproof and dusttight as defined by IEC IP65 and provides the watertight protection of NEMA Type 4.

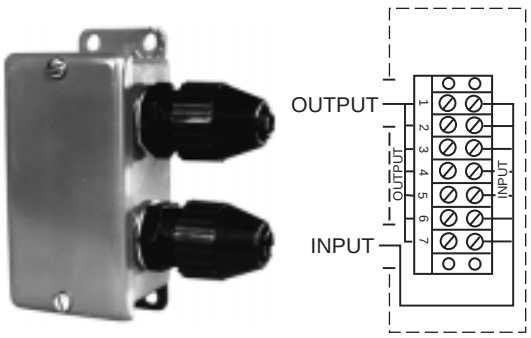


Figure 9. Junction Box and Terminal Collections
(Foxboro Part 0051052 Illustrated)

Patch Cord

Patch cords provide connections between sensors with optional selections –5 and –7 and either an analyzer, transmitter, or junction box. Specify Foxboro Part BS806NP for the standard 3 m (10 ft) length or BS806NQ for the nonstandard lengths up to 30 m (100 ft).

ACCESSORIES (Cont.)

Extension Cable Assembly

The extension cable assembly (see Figure 10) is a PVC jacketed multi-conductor cable that provides intra-system connections to applicable pH instruments. Numbered leads, terminated in spade terminals, allows the extension cable to be connected to the terminals in the junction box (see Figure 9).

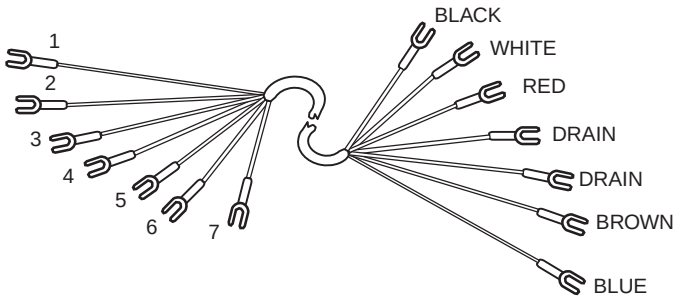


Figure 10. Extension Cable Assembly
(Foxboro Part 0060301 Illustrated)

Extension Cable

The extension cable (see Figure 11) is a PVC jacketed multi-conductor cable, unterminated, that provides intra-system connections.

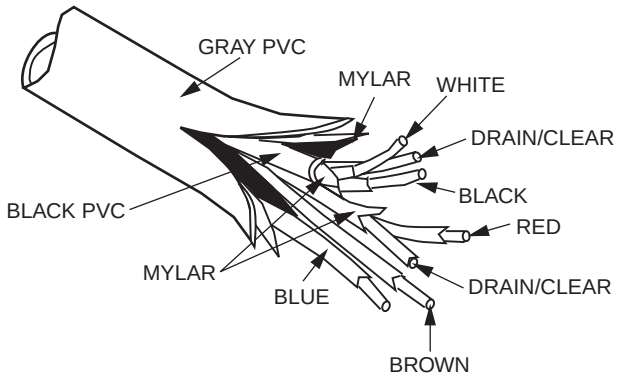


Figure 11. Extension Cable
(Foxboro Part 6000-130 Illustrated)

Buffers

Buffers (see Table 6) are available in dry powder and solution. Dry powder makes 0.47 L (16 fl oz) of buffer when mixed with distilled water.

Table 6. Buffers

Type Buffer	Description	Foxboro Part
Solution	Buffer 4.00 pH, 0.47 L (16 fl oz)	Q0104KC
	Buffer 7.00 pH, 0.47 L (16 fl oz)	Q0104KB
	Buffer 10.0 pH, 0.47 L (16 fl oz)	Q0104KA
Dry Powder	4.00 pH	1600-100
	7.00 pH	1600-101
	10.0 pH	1600-102

ACCESSORIES (Cont.)

Electrode and Reference Kits

The electrode and reference kits (see Table 7) provide all the parts necessary for fast and easy field installation.

The electrode kit contains a measuring electrode, replacement locking keeper and stud, electrode removal tool, and complete instructions.

The reference kit contains replaceable reference junction, a 50 ml bottle of saturated potassium chloride (KCl) filling solution, replacement locking keeper and stud, electrode removal tool, and complete instructions.

Table 7. Electrode and Reference Kits

Description	Foxboro Part with Titanium Keeper and Stud (Wetted Part)	Electrode Body Material	O-Ring Material
Flat Glass pH Kit	BS805MD	Ryton	Viton
Spherical Glass pH Kit	0022505		
Spherical Glass pH Kit	0022504(b)		
Antimony pH Kit	0022506		
Platinum ORP Kit	0022507		
Gold ORP Kit	0022508		
Reference Kit(a)	0022703		
Fluoride Kit	BS806MV	Epoxy	Viton
Fluoride Kit(c)	BS806MW(c)		
Spherical Glass pH Kit	0022510	ptfe	Viton
Reference Kit(a)	0022705		
Platinum ORP Kit	0022532	ctfe	Viton
Reference Kit(a)	0022713(b)	Ryton	Viton
Reference Kit(d)	BS806UN	Epoxy	Viton

(a) In addition to hardware, also contains a bottle of saturated KCl filling solution.
(b) Similar to Part 0022505 or 0022703 except with short titanium screw in place of keeper stud. For use with Electrode Cleaning Systems (ECS) (see PSS 6-1A2 C).
(c) Similar to BS806MV except with Monel wetted parts.
(d) For fluoride and pure water pH measurements.

Multiple Electrode and Reference Kits

The multiple measuring electrode kits (see Table 8) contain ten measuring electrodes, one replacement locking keeper and stud, an electrode removal tool, and complete instructions.

The multiple reference electrode kits (see Table 8) contain ten replacement reference junctions, 500 mL of saturated potassium chloride (KCl) filling solution, one replacement locking keeper and stud, an electrode removal tool, and complete instructions.

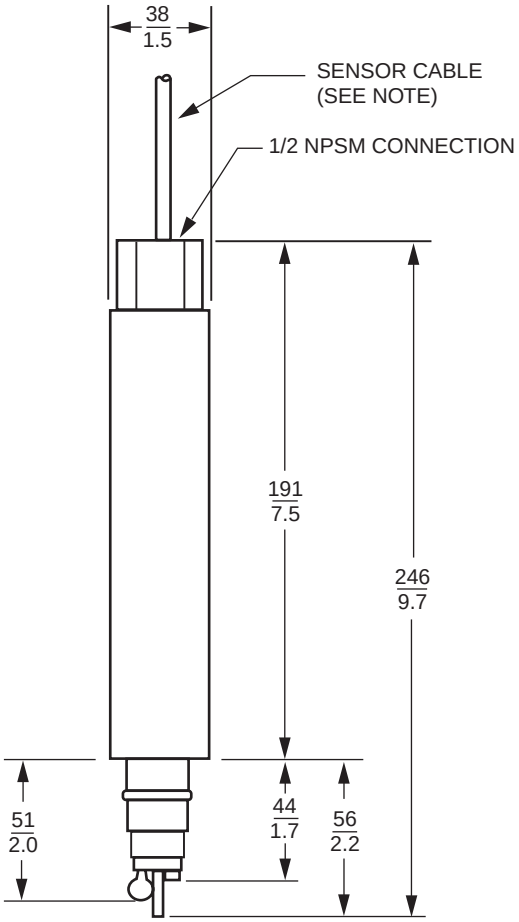
Table 8. Multiple Electrode and Reference Kits

Description	Foxboro Part with Titanium Keeper and Stud (Wetted Part)	Electrode Body Material	O-Ring Material
Flat Glass pH Kit	BS805WD	Ryton	Viton
Spherical Glass pH Kit	BS805WC		
Antimony pH Kit	BS805WM		
Reference Kit	BS805YP		
Spherical Glass pH Kit	BS805YN	ptfe	Viton
Reference Kit	BS805YQ		
Reference Cavity Filling Solution, Concentrated KCl, 500 mL	BS805YR	Not Applicable	Not Applicable

DIMENSIONS–NOMINAL

mm
in

871PH SENSOR



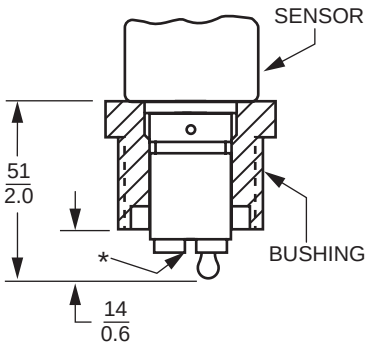
NOTE:

THE STANDARD CABLE LENGTH IS 6 m (20 ft).
THE CABLE IS TERMINATED WITH NO. 6 SPADE TERMINALS, OR STRIPPED AND TINNED. OPTIONAL CABLE LENGTHS ARE AVAILABLE.

DIMENSIONS–NOMINAL (Cont.)

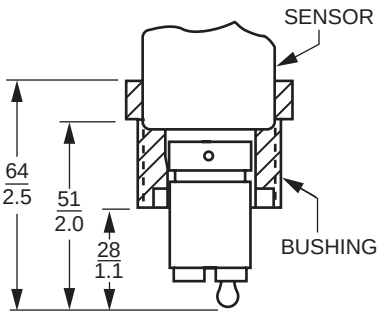
mm
in

SENSOR ACCESSORIES

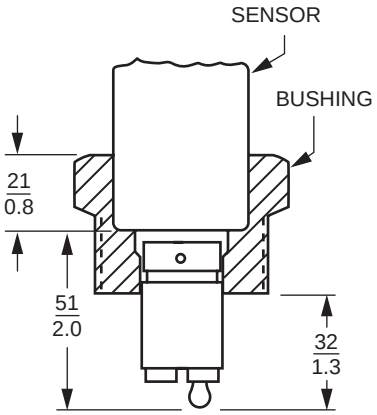


1 1/4 NPT (PVC)
FOXBORO PART 0051183

BUSHINGS

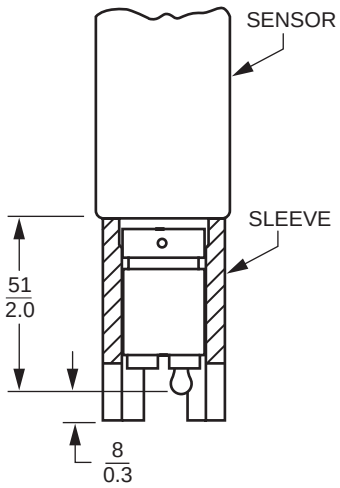


1 1/4 NPT (316 ss)
FOXBORO PART 0051185



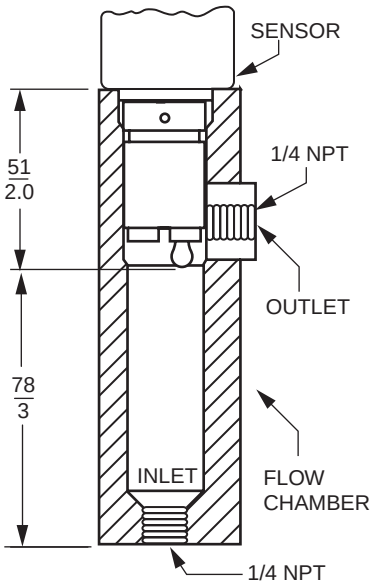
1 1/2 NPT (316 ss)
FOXBORO PART 0051186

ELECTRODE PROTECTION SLEEVE



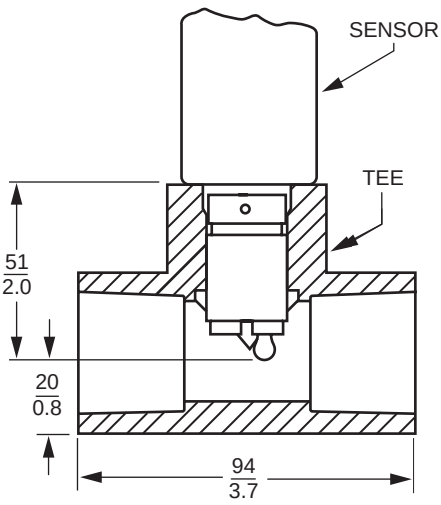
PVC
FOXBORO PART 0051189

FLOW CHAMBER



PVC
FOXBORO PART 0051181
316 ss
FOXBORO PART 0051179

TEE



DN 25 OR 1 in (PVC)
FOXBORO PART 0051184

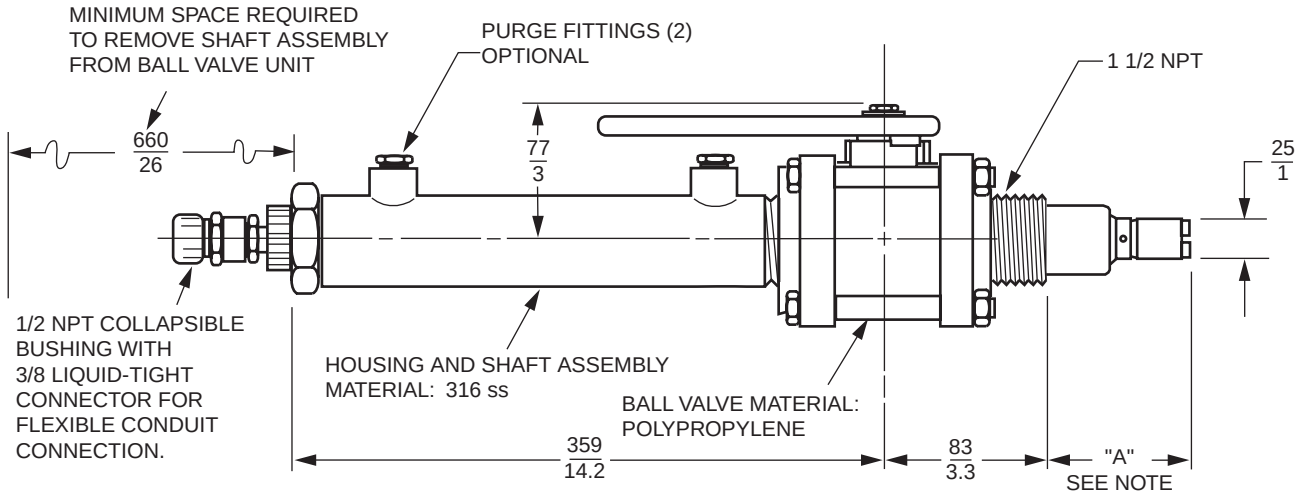
* FOR DIMENSIONS WITH KEEPER STUD, REFER TO PREVIOUS PAGE.

DIMENSIONS–NOMINAL (Cont.)

mm
in

SENSOR ACCESSORIES (Cont.)

BALL VALVE ASSEMBLY WITH 316 ss PROCESS CONNECTION AND HOUSING

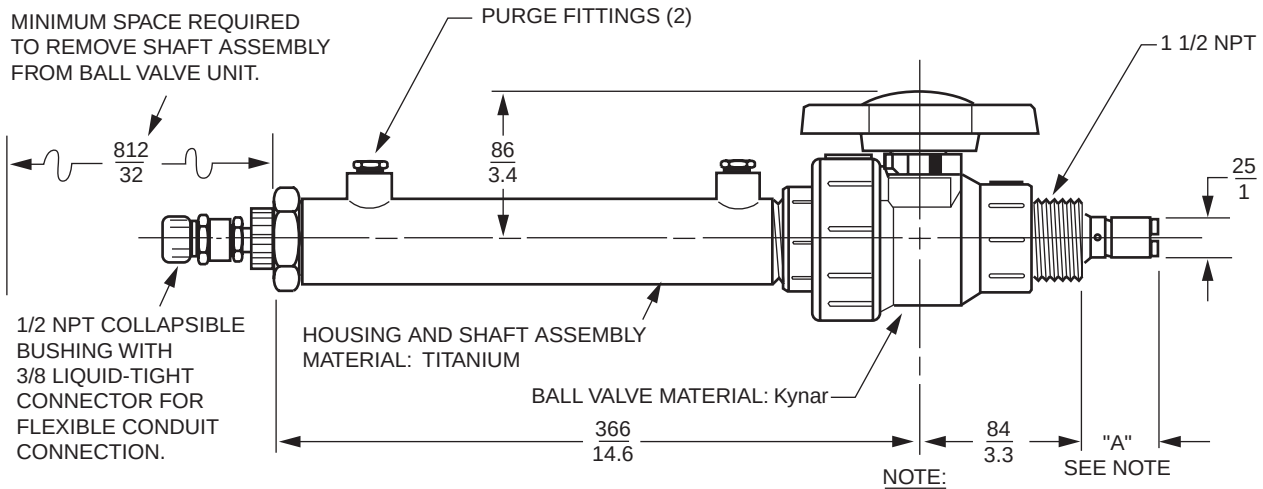


DESCRIPTION	FOXBORO PART
WITH PURGEABLE HOUSING	BS805JP (a)
WITH NONPURGEABLE HOUSING	BS805JN (b)

(a) PREVIOUSLY SPECIFIED AS 0051380 PLUS 0051362.
(b) PREVIOUSLY SPECIFIED AS 0051361 PLUS 0051362

NOTE:
DIMENSION "A" IS 61 mm (2.4 in) NOMINAL WHEN FOXBORO SUBMERSION ADAPTOR (INTERNAL TO HOUSING ASSEMBLY) PART NUMBER BS805PU OR BS805PV IS USED. IF SUBMERSION ADAPTOR IS NOT USED, DIMENSION "A" IS 21 mm (0.8 in) NOMINAL. LONGER INSERTION SHAFT LENGTHS AVAILABLE ON SPECIAL ORDER.

BALL VALVE ASSEMBLY WITH TITANIUM PROCESS CONNECTION AND HOUSING



DESCRIPTION	FOXBORO PART
WITH PURGEABLE HOUSING	BS805JQ (a)

(a) PREVIOUSLY SPECIFIED AS 0051360 PLUS 0051365.

NOTE:
DIMENSION "A" IS 94 mm (3.7 in) NOMINAL WHEN FOXBORO SUBMERSION ADAPTOR (INTERNAL TO HOUSING ASSEMBLY) PART NUMBER BS805PU OR BS805PV IS USED. IF SUBMERSION ADAPTOR IS NOT USED, DIMENSION "A" IS 53 mm (2.1 in) NOMINAL. LONGER INSERTION SHAFT LENGTHS AVAILABLE ON SPECIAL ORDER.

REFERENCE DOCUMENTS

PSS 6-1B1 B	870ITPH Intelligent pH/ORP Electrochemical Transmitters
PSS 6-1C1 A	870PH Analog pH/ORP Electrochemical Transmitters
PSS 6-1C1 E	873 Series Electrochemical Analyzers
PSS 6-1A2 C	Electrode Cleaning System (ECS)

ORDERING INSTRUCTIONS

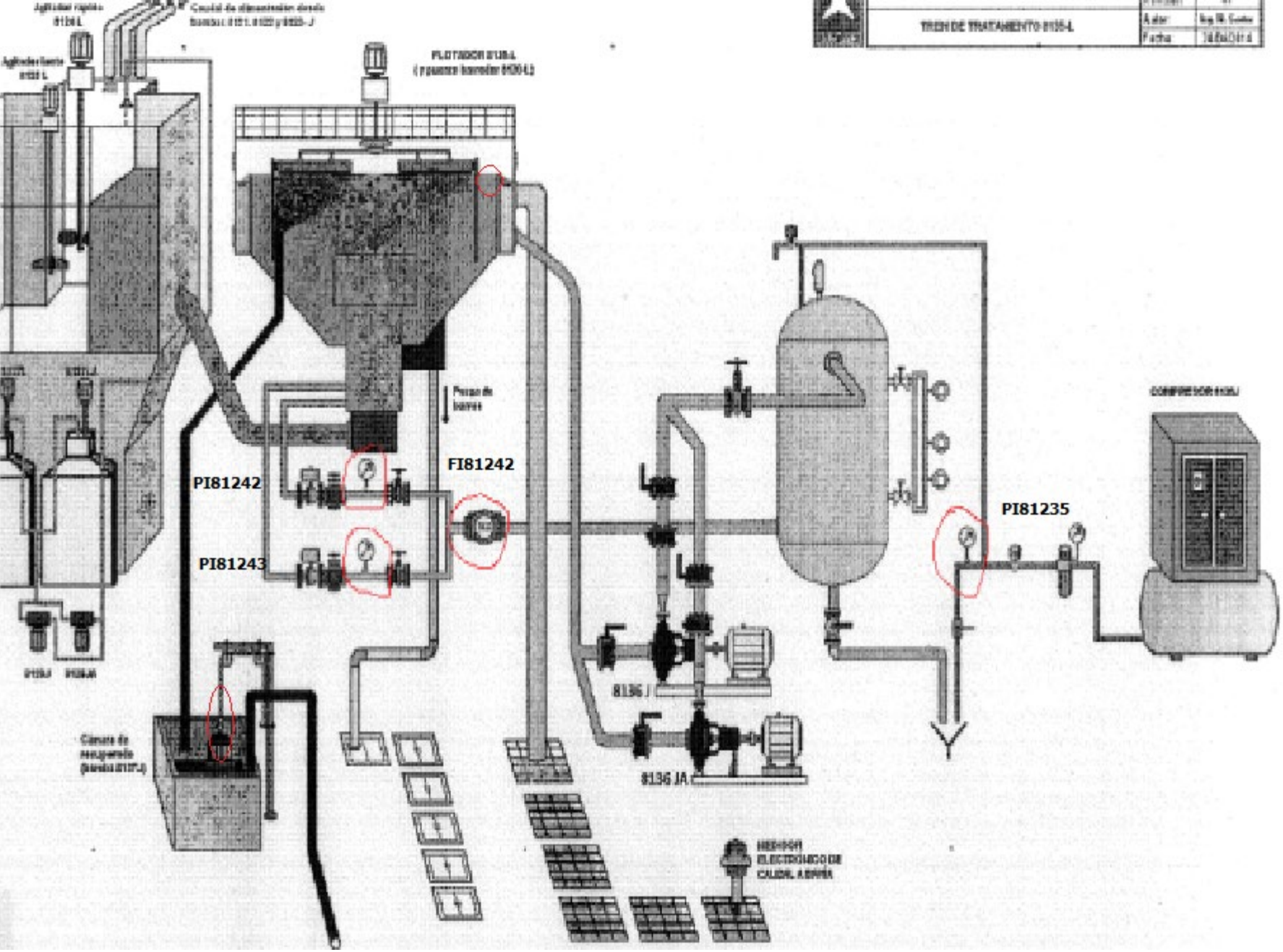
1. Model Number.
2. Cable length, if nonstandard.
3. Mounting hardware, if required.
4. Cable and junction box, or patch cord, if required.
5. Accessories, if required.
6. Customer Tag Data.

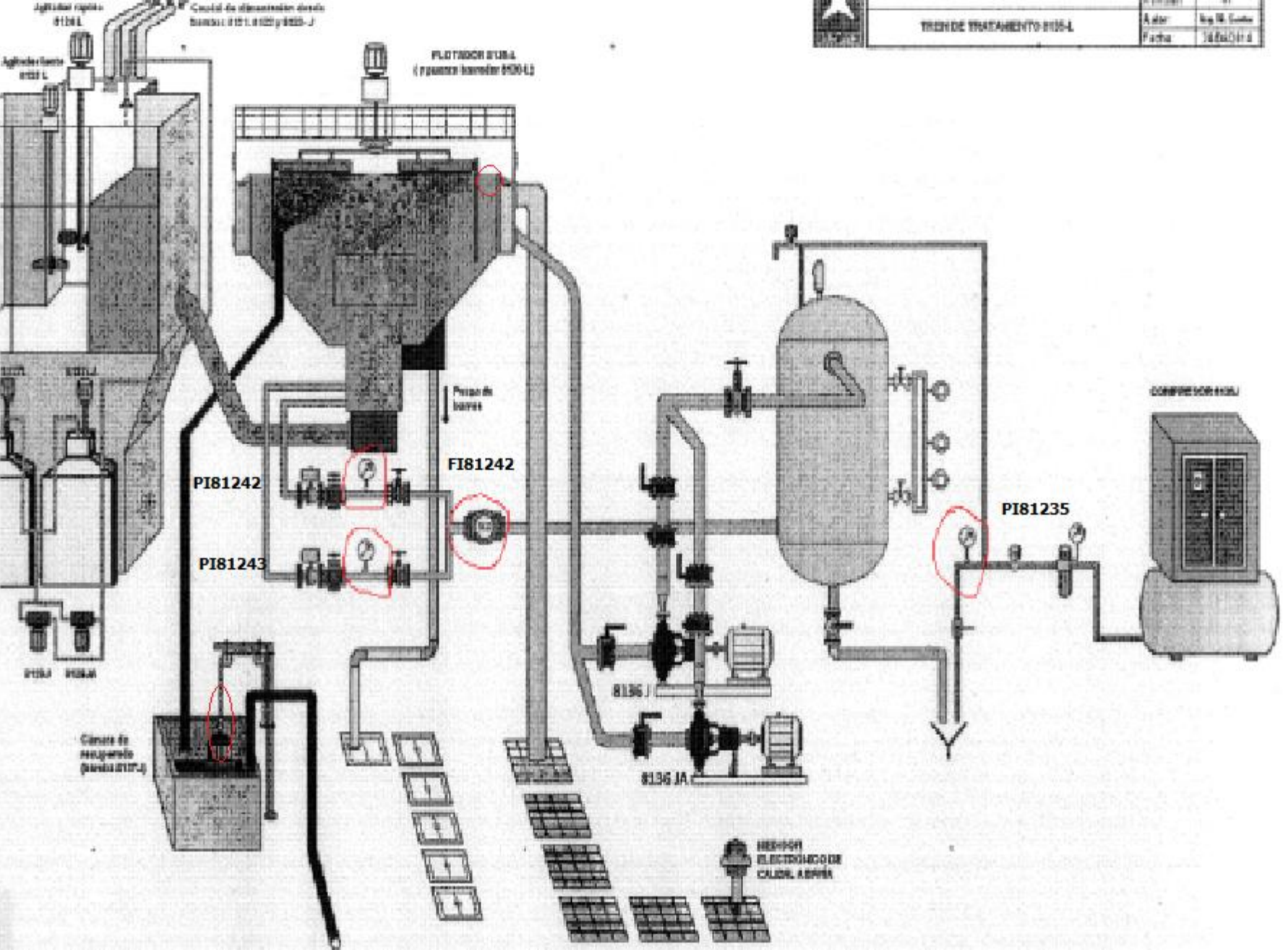
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PI81243
PI81235
8136 J
8136 JA


PI81242
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8136 J
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INT ET 002/2006

Cableado eléctrico de instrumentos

REV.	FECHA	DESCRIPCION	PREPARADO POR	APROBADO POR

INDICE DE REVISIONES

PÁGINA	REVISIÓN	FECHA

INDICE

I. ALCANCE 5
II. ESPECIFICACIONES DE REFERENCIA 5
III. CODIGOS Y REGLAMENTOS 5
IV. CLASIFICACION DE AREAS 6
A. General 6
B. Clasificación de Equipos. 6
V. INSTALACION DE CABLES 8
A. General 8
B. Multicable. 8
C. Cable Simple. 8
D. Conduit. 8
E. Conductores de Reserva. 9
F. Hilos Telefónicos. 9
VI. SEPARACION DE LOS CABLES DE INSTRUMENTOS 9
VII. ESPECIFICACION DE CABLES 10
VIII. IDENTIFICACION DE CABLES 10
IX. PROTECCION CONTRA LA HUMEDAD 11
X. PUESTA A TIERRA DE EQUIPOS Y CIRCUITOS 11
A. General 11
B. Pantallas de Cables. 12
C. Armadura de Cables. 12
D. Circuitos de Termopares. 12
E. Señales Analógicas de Alto Nivel. 13
XI. CABLEADO DE INSTRUMENTOS 13
A. General 13
B. Cableado de Control. 13
C. Cableado de Termopares. 14
XII. CABLEADO DE EQUIPO CON SEGURIDAD INTRINSECA 14
XIII. TERMINALES 15

INDICE DE ESPECIFICACIONES

1.A. Señales Analógicas alto nivel, 4- 20 m CC (seguridad intrínseca).....16
1.B. Señales de Termorresistencia.....17
1.C. Señales Analógicas Alto nivel (24 d.c., 4- 20 ma) y Señales de Termorresistencia.....18
1.D. Señales de Termorresistencia.....19
2.A. Señales Analógicas de Bajo Nivel (termopares tipo K) de seguridad intrínseca.....20
2.B. Señales Analógicas de Bajo Nivel (termopares tipo K) de seguridad intrínseca.....21
2.C. Señales Analógicas de Bajo Nivel (termopares tipo J) de seguridad intrínseca.....22
2.D. Señales Analógicas de Bajo Nivel (termopares tipo J) de seguridad intrínseca.....23
3.A. Señales Anunciadoras de Alarmas (24 VDC/mA Sólo).....24
3.B. Señales Anunciadoras de Alarmas (24 VDC/mA Sólo).....25
4.A. Alimentación instrumentos (110 vac para solenoides, instrumentos de campo, etc.).....26
4.B. Alimentación instrumentos de 110 VAC para disparos solenoides, otros instrumentos de campo) ...27

I. ALCANCE

Esta especificación cubre los requerimientos de cableado y las consideraciones de diseño que se refieran a sistemas de señales de alto y bajo nivel dentro de instrumentación, tales como instrumentos electrónicos, termopares, alarmas, termómetros de resistencia, alimentaciones y todos los sistemas de seguridad intrínseca.

II. ESPECIFICACIONES DE REFERENCIA

La siguiente documentación será considerada como parte de esta especificación cuando sea aplicable:

1. INT ET 001 Instrumentación
2. ELE ET 003 Electricidad
3. Cajas de Derivación y Conexiones Termopares

III. CODIGOS Y REGLAMENTOS

Excepto cuando sea indicado expresamente en esta especificación, el diseño instalación del material eléctrico de instrumentos cubrirá los requisitos exigidos en las últimas mediciones de los siguientes standards y códigos:

a. The National Electrical Code
b. The National Electrical Safety Code
c. API Standard RP-500
d. API Standard RP-540
e. API Standard RP-550 Part I

IV. CLASIFICACION DE AREAS

A. General.

1. Todas las áreas de proceso serán clasificadas de acuerdo con la especificación eléctrica.
2. La especificación para todos los materiales e instalaciones eléctricas de los instrumentos, estará en completo acuerdo con los requisitos exigidos por el "National Electric Code" (NEC) o las "Normas de la Comisión Electrotécnica Internacional" (CEI).

   Preferiblemente el método de protección será denominado de "Seguridad Intrínseca Exi" y a las instrumentos, elementos y componentes que lo necesiten, según la reglamentación, se les exigirá un certificado de prototipo extendido por uno de los siguientes laboratorios acreditados:

   a. PTB (Europa)
   b. F.M. (USA)
   c. BASEEFA (U.K.)
   d. UL (USA)

   Este certificado estará de acuerdo al menos con una de las siguientes normas:

   a. Una norma Europea E.N. (CENELEC)
   b. Una recomendación CEI.
   c. NEC
3. Los instrumentos, elementos, componentes, etc. que necesiten certificado de "Seguridad Intrínseca Exi", éste será para áreas clasificadas según NEC como Clase I, Divi. l y Grupos B, C y D.

B. Clasificación de Equipos.

1. Equipos montados en Sala de Control Nueva.

   Todos los equipos, métodos de cableado e instalación serán de Características Generales para situar en una Sala de Control presurizada, acondicionada y ventilada convenientemente.

   Los elementos y componentes (barreras Zener, aisladores galvánicos, relés de S.I., etc. que lo necesiten por formar parte de sistemas de "Seguridad Intrínseca", estarán de acuerdo con lo dicho en el apartado "General" anterior. Así mismo, el cableado, instalación, etc., será en estos casos realizado adecuadamente y considerando las recomendaciones del organismo de certificación y la reglamentación existente en cuanto a caminos, distancias, colores, etc.

2. Equipos Montados en Campo

   a. Tal como se ha dicho en el apartado IV.A (General) y refiriéndose en este caso a instrumentos eléctricos y electrónicos con sus circuitos asociados montados en campo, estos irán preferiblemente ligados a sistemas de "Seguridad Intrínseca Exi". A este efecto los aparatos y sus circuitos asociados que lo necesiten deberán ser adecuadamente certificados y sus métodos de cableado e instalación estarán de acuerdo con la reglamentación existente y con las recomendaciones del organismo que haga la certificación.

   b. Caso de elegir otra opción que la de "Seguridad Intrínseca" (a prueba de explosión, seguridad aumentada, etc.), los instrumentos que lo necesiten serán aptos para ser instalados en el área de clasificación donde vayan a ser montados y están adecuadamente certificados. A este efecto la clasificación mínima será Clase I, Grupos C y D, Div. II, aunque en su momento será definida para cada aparato la correcta y específica clasificación del área donde se instalen.

   c. Se procurará que los paneles locales (Hornos y Compresores) se instalen en áreas sin clasificar. Si esto no es así, los sistemas de enclavamiento ligados a dichos equipos podrán instalarse en dichos paneles, protegiéndolos adecuadamente, preferentemente purgando el gabinete.

   d. Los elementos iniciadores de campo (presóstatos, termostatos, etc.) en el caso de equipos paquetes (compresores, turbinas, etc.), deberán tener el método de protección denominado "a prueba de explosión" (explosión proof) adecuado para el área especificada de clasificación definida en cada requisición. En el resto de los casos y tal como se ha venido apuntando, en que dichos aparatos vayan instalados en zonas clasificadas, estos serán NEMA IV y ligados a sistemas de "Seguridad Intrínseca" (barreras Zener, réles SI, separadores galvánicos, tarjetas de entrada aprobadas, etc.).

V. INSTALACION DE CABLES

A. General.

El cableado entre la Sala de Control y los instrumentos en campo, será mediante multicables, dentro de bandejas cerradas, que terminarán en campo en una caja de derivación localizada a 1,25 metros sobre el suelo aproximadamente.

El cableado entre las cajas de derivación y los instrumentos será por cable de dos o tres conductores apantallados y trenzados.

1. Todas las entradas de cables deben ser tales que eviten posibles focos de fuego y/o alta temperatura, aislándose convenientemente cuando esto sea posible.
2. Las cajas de derivación deberán ser localizadas de modo que la interconexión entre éstas y los instrumentos electrónicos locales, tengan el menor recorrido posible.
3. Los cables entrarán en las cajas por las partes inferior y laterales de estas.

B. Multicable.

1. El recorrido de multicables a través de las unidades de proceso hasta la Sala de Control será aérea, en "conduit" metálico galvanizado en caliente o bandeja cerrada.

C. Cable Simple.

1. El recorrido de cables simples entre cajas de conexión e instrumentos será aéreo y bajo "conduit" de aéreo galvanizado en caliente. En este caso el cable no será armado.

D. Conduit.

1. El conduit cuando sea utilizado será de acero rígido galvanizado interior y exteriormente por inmersión en caliente, con rosca NPT boquillas de protección de plástico y se sellará con pasta compound.
2. El conduit rígido cumplirá con la norma ANSI C-80.1.

E. Conductores de Reserva.

1. Los multicables serán previstos con reserva suficiente al inicio del diseño. No menos del 15% de reservas se preverá para el momento de arranque de 1a planta para posibles aplicaciones y mantenimiento.
2. Todos los pares de reserva serán conectados y perfectamente identificados en la sala de control y en las cajas de derivación.
3. Las cajas de derivación tendrán agujeros suficientes para permitir que todas las reservas puedan ser utilizadas cuando se considere oportuno. Los agujeros no utilizados estarán adecuadamente protegidos y sellados con silicona para mantener la estanqueidad de la caja.

F. Hilos Telefónicos.

Cada multicable tendrá un par de hilos telefónicos, que serán conectados en ambas extremos, esto es, en 1a caja de derivación y en la Sala de Control.

VI. SEPARACION DE LOS CABLES DE INSTRUMENTOS

A. Entre los cables de instrumentos y las fuentes posibles de interferencias (interruptores, paneles de contactores, paneles de control de motores, rectificadores, transformadores y máquinas rotativas) se mantendrá la máxima separación posible.

B. Como regla general, un mínimo de 3 metros se debe dejar entre las fuentes de posibles interferencias y los terminales abiertos de los instrumentos.

Todos los equipos eléctricos generadores de ruido e interferencias, deberán ser cubiertos con una envoltura metálica siempre que sea posible. Los racks que contengan regletas de terminales para instrumentos deberán ser totalmente metálicos.

C. Entre cables de instrumentos y cables de potencia, en recorridos paralelos, se mantendrá la máxima separación posible.

D. Si los recorridos paralelos entre cables de instrumentos y cables de potencia no pueden ser evitados, el mínimo espacio entre estos permitidos será:

125 V	Máx.	10 A	500 mm
250 V	Máx.	50 A	750 mm
500 V	Máx.	200 A	1000 mm
6 KV	Máx.	800 A	2000 mm

E. Cuando los cables de instrumentos y los cables de potencia se crucen, las distancias del apartado VI. D se podrán reducir, siempre y cuando el cruce sea en ángulo recto.

En estos cruces, los cables de instrumentos podrán ir bajo conduit metálico o metal dúctil. El mínimo espacio entre cables de instrumentos y de potencia en los cruces a 90º será de 10 cm.

F. Cuando los cables de instrumentos de señales analógicas de alto nivel (transmisores de proceso a 24 VDC) y bajo nivel (termopares) recorran las mismas zanjas con señales de alarma o cables de potencia para instrumentos; éste último será instalado, siempre que sea posible, en el lado próximo a posibles cables de potencia que tengan recorridos paralelos.

G. Las señales de bajo nivel (termopares) estarán separadas 300 mm. como mínimo del resto de cables y no compartirán la bandeja con ningún otro cable en tendidos aéreos.

H. El cableado intrínsecamente seguro se separará de cualquier otro cableado de señal y/o de potencia, tal como se indica en la Sección XII.

VII. ESPECIFICACION DE CABLES

A. Los cables serán seleccionados de acuerdo con esta especificación.

B. En el caso de instrumentos especiales, tales como analizadores, turbinas de caudal, niveles en tanques, etc., los cables se suministrarán en estricto acuerdo con la especificación requerida por el fabricante del equipo. Estos cables especiales serán provistos, en cualquier caso con pantalla, armadura, y cubierta exterior de acuerdo con los requisitos generales de esta especificación.

C. El aislamiento de P.V.C. será resistente a la humedad de acuerdo con el NEC, artículo 310 tipo THWN. La cubierta exterior será resistente a la humedad y a los hidrocarburos.

D. Todos los cables de instrumentos deberán ser instalados en una sola tirada, sin empalmes de ningún tipo.

VIII. IDENTIFICACION DE CABLES

E. Todos los cables y sus extremos serán identificados con marcas y códigos de acuerdo con las características del cable.

F. Los cables enterrados serán marcados con placas de identificación plomo en sus extremos y cada 10 metros en toda la longitud del cable; cada placa de identificación será marcada con el código del cable correspondiente. Los elementos de sujeción de las placas serán de plomo, acero, inoxidable o poliamida.

G. Los cables aéreos serán marcados con placas de identificación en aluminio o acero inoxidable de acuerdo con el apartado anterior. Los elementos de sujeción de las placas serán de aluminio, acero inoxidable o poliamida.

H. Las cubiertas de las zanjas y la situación de las placas de identificación estarán de acuerdo con la especificación eléctrica y con los standards de detalle.

I. La identificación de los conductores de los multicables será de acuerdo con la especificación del cable en particular.

J. Todos los terminales y conductores serán identificados de acuerdo con los diagramas de cableado. Etiquetas individuales de plástico de Cristchley tipo "C" o similar, serán previstas para todos los terminales de cables.

IX. PROTECCION CONTRA LA HUMEDAD

A. Todos los recorridos de cables serán diseñados para evitar las acumulaciones de agua.

B. Todos los instrumentos de campo estarán previstos de juntas estancas resistentes en su totalidad a prueba de intemperie con protección IP-55 como mínimo.

C. Todas las cajas de derivación serán a prueba de intemperie y serán previstas con dispositivos de venteo y drenaje. Un compuesto de silicona "Silastic" o similar será aplicado a todas las juntas de las cajas de derivación después de su instalación, cableado y pruebas.

D. Una vez terminado el conexionado eléctrico, todos los terminales de las cajas de derivación, transmisores, interruptores, etc., serán cubiertos con una capa de dieléctrico de gran aislamiento aplicado con pulverizador. En el interior de cada caja se pondrá una pastilla de inhibidor de corrosión "CORTEC" o equivalente.

E. Las cabezas de los termopares serán a prueba de intemperie como mínimo.

F. Las bandejas tendrán pendiente suficiente para permitir drenaje de posibles líquidos y condensables.

X. PUESTA A TIERRA DE EQUIPOS Y CIRCUITOS

A. General.

1. Los circuitos de instrumentos se pondrán a tierra para reducir los efectos de interferencias eléctricas sobre la señal que se transmita. Se seguirán cuidadosamente todas las instrucciones dadas por el fabricante de los instrumentos.

2. En general se aplicarán las siguientes reglas:
   a. Los circuitos de un lazo en corriente continua se pondrán a tierra únicamente en un solo punto.
   b. Normalmente, la puesta a tierra se localizará en el polo negativo de la alimentación del lazo.
   c. Todo elemento metálico en contacto con los circuitos de seguridad intrínseca (P.e.: Bandejas, cajas de derivación, etc.) deberá ser puesto a tierra en la red general eléctrica.

B. Pantallas de Cables.

1. Todas las pantallas de los cables serán puestas a tierra en un punto únicamente, que estará en la Sala de Control (paneles, racks, consolas, etc.), excepto para termopares, las cuales estarán puestas a tierra en la cabeza de éste.
2. La continuidad de la pantalla será mantenida durante todo el recorrido del cable. Las pantallas serán aisladas respecto a la tierra de los instrumentos y las cajas de derivación. Esto se aplica tanto a las pantallas individuales como a las generales.

C. Armadura de Cables.

1. Todas las armaduras de los cables serán puestas a tierra en un único punto, siendo éste la caja de derivación en campo.
2. Estas serán aisladas de la tierra en Sala de Control.

D. Circuitos de Termopares.

1. Todos los instrumentos que reciban señales de termopares estarán preparados para recibir éstos, tanto sean puestos a tierra (grounded) o aislados de ésta (ungrounded).
2. El sistema de pantalla de cables y multicables de termopares será: puestos a tierra en la cabeza de estos.
3. Los puntos l y 2 anteriores, en cualquier caso, estarán supeditados a los requisitos que el certificado de S.1. fije en cada caso, o bien lo que el vendedor del equipo requiera.

E. Señales Analógicas de Alto Nivel.

Estas señales serán puestas a tierra en la Sala de Control únicamente

Nota :

En la Sala de Control, los equipos que reciban este tipo de señal, llevarán una tierra de características tales, que cumpla con las requisitos de "Seguridad Intrínseca", "no Seguridad Intrínseca", etc.

XI. CABLEADO DE INSTRUMENTOS

A. General.

1. Todos los instrumentos de indicación, control y registro en Sala de Control, operarán con señal de voltaje medida a través de resistencias calibradas suministradas por el Vendedor de la instrumentación de Sala de Control. Los miliamperimetros en cualquier lazo serán provistos de un shunt.
2. Se seguirán las recomendaciones dadas por el Vendedor cuando se trate de cablear equipos especiales tales como turbinas, transmisores magnéticos de flujo, analizadores, etc.
3. Cada par de conductores deberá ser adecuadamente identificado en cualquier unión donde estén presentes otros conductores. Todos los terminales serán claramente identificados. Los terminales a la entrada de la Sala de Control serán etiquetados con la sigla del instrumento correspondiente.

B. Cableado de Control.

1. La carga resistiva que se pueda poner a cada generador de señal, la cual estará indicada en la información técnica del fabricante de la instrumentación, nunca debe ser excedida.
2. Los receptores de señales en voltaje tendrán una impedancia lo más próxima a infinito respecto a la impedancia en el resto del circuito. Esta incluye la impedancia del cable y la impedancia de salida del generador de señal.

C. Cableado de Termopares.

1. El uso de termopares múltiples es permitido siempre que así se muestre en los diagramas de flujo.
2. La puesta a tierra de termopares será como se indica en X.D.
3. Las conexiones y cableado de cajas para termopares se realizarán según standard ANCAP.

XII. CABLEADO DE EQUIPO CON SEGURIDAD INTRINSECA

A. No se mezclarán equipos intrínsecamente seguros, procedentes de diferentes vendedores, sin que se haya investigado la compatibilidad de certificaciones.

B. La instalación de barreras Zener cumplirá con lo siguiente:

1. Separación de los cables intrínsecamente seguros y los terminales.
2. Protección de las barreras Zener contra polvo, humedad y exposición a una temperatura ambiente superior a 50ºC y vibraciones severas.
3. Se prevendrá el exponer las barreras a la luz directa del sol o fuentes radiantes de calor.
4. Adecuado montaje y puesta a tierra de la barrera.
5. El cable pantalla nunca puenteará la barrera.

C. Para asegurarse un sistema de seguridad intrínseca cuando se utilizan barreras:

1. No habrá intrusión de potenciales externos que excedan el rating de la barrera en el lado peligroso de la barrera.
2. No habrá ningún sistema de almacenamiento de energía (capacitivo o inductivo) en exceso del máximo permitido por el diseño de la barrera, en el lado peligroso de la barrera.

D. Generalmente la resistencia de la barrera Zener de seguridad representa un alto porcentaje de la capacidad de carga de un transmisor o un regulador.

Por lo tanto, se hará una comprobación para asegurarse que la resistencia requerida por el cableado más la de otros dispositivos conectados en serie, no excede de la máxima impedancia de carga del instrumento.

E. Cuando la Seguridad Intrínseca no sea mantenida por barreras Zener sino por Separadores Galvánicos, se cumplirán las especificaciones concretas de Seguridad Intrínseca para estos dispositivos.

F. El tendido de cables de Seguridad Intrínseca en la zanja de cables de hará de forma que haya una separación física entre los cables de Seguridad Intrínseca y los que no lo son. Esta barrera física podría ser un murete de ladrillos.

G. Los recorridos de cables dentro de la Sala de Control han de hacerse en canaletas independientes para los cables de Seguridad Intrínseca.

H. Los cables sencillos de Seguridad Intrínseca que partiendo de los transmisores o de los convertidores I/P vayan hacia las diferentes cajas de derivación en la Planta, no podrán compartir la bandeja con otros hilos que no sean intrínsecamente seguros.

XIII. TERMINALES

A. El tamaño de los bloques de terminales y sus tornillos serán consistentes con el tamaño del cable utilizado con ellos. La terminación de los cables serán:

1. Del tipo "captive" utilizado con cables que llevan "spade" en el extremo.
2. Del tipo "modular" que utilizan mordaza para el extremo del cable.

   Para el caso de hilos trenzados se requiere que estos sean provistos de manguito. Los tornillos serán del tipo "captive" y no entrarán en contacto nunca ni con los hilos ni con el manguito ni con el extremo en punzón.

B. Los terminales no serán higroscópicos.

C. Los terminales con muelle no son aceptables.

D. Los terminales estarán plateados o estañados.

E. Los terminales serán adecuadamente identificados.

ESPECIFICACIÓN 1.A. - SEÑALES ANALÓGICAS ALTO NIVEL

SERVICIO	SEÑALES ANALÓGICAS ALTO NIVEL, 4- 20 m CC (SEGURIDAD INTRÍNSECA)		
RUTA	AÉREO (TODAS LAS AREAS)	TIPO	UN PAR MAS ECUALIZADO
CONDUCTORES	HILOS DE COBRE TRENZADOS DE: 1,32 mm^2 PARA CONDUCTOR VERDE Y PARA VERDE Y AZUL 1,76 mm^2 PARA CONDUCTOR AMARILLO/VERDE (ECUALIZADOR)		
AISLAMIENTO	PVC (0,4 mm DE ESPESOR) Y PARA 75º DE TEMPERATURA COMO MÍNIMO	COLOR	UNO VERDE, UNO AZUL Y UNO AMARILLO/VERDE
TRENZADO CADA PAR	(NOTA 2) CADA 50 mm	TRENZADO TOTAL	
PANTALLA POR POR	CINTA DE ALUMINIO/MYLAR APLICADA EN HÉLICE CON UN 25 % DE SOLAPE MÍNIMO, CON HILO DE DRENAJE DE COBRE FLEXIBLE Y ESTAÑADO DE 0,5 mm^2, EN CONTINUO CONTACTO CON EL ALUMINIO (NOTA 2)		
PAR DE COMUNICACIÓN		COLOR	
ENVOLTURA INTERNA	PVC (0,4 MM DE ESPESOR) Y PARA 75º DE TEMPERATURA COMO MÍNIMO	COLOR	AZUL
FUNDA			
ARMADURA	ALAMBRE DE ACERO RECOCIDO GALVANIZADO DE ∅ 0,5 mm CON RECUBRIMIENTO MÍNIMO DE UN 90 %		
ENVOLTURA EXTERNA	PVC (1,14 mm DE ESPESOR) Y PARA 75º DE TEMPERATURA COMO MÍNIMO	COLOR	AZUL
DIÁMETRO EXTERIOR		DIÁM. BAJO ARMADURA	MÍNIMO : 10 mm MÁXIMO: 11 mm
IDENTIFICACION DEL CABLE		PLACAS IDENTIFI-CACIÓN	DE ALUMINIO EN LOS TERMINALES Y CADA 10 m (NOTA 1)
PRENSAS	DE LATÓN CADMIADO, DOBLE SELLO, A PRUEBA DE INTEMPERIE, ½ " NPT, FUNDA EXTERIOR DE PVC		

NOTA 1: La identificación será realizada por el Subcontratista de Montaje.

NOTA 2: Para conductores azul y verde solamente.

NOTA 3: El conductor amarillo/ verde será localizado exterior a la pantalla general e interior de la envoltura interna.

NOTA 4: Máxima resistencia: 30 Ω/km
Máxima Capacidad: 0,2 µF/km
Máxima Inductancia: 2mH/km
* Máxima longitud disponible: 500 m

ESPECIFICACIÓN 1.B. - SEÑALES DE TERMORRESISTENCIA

SERVICIO	SEÑALES DE TERMORRESISTENCIA		
RUTA	AÉREO (TODAS LAS AREAS)	TIPO	TRES CONDUCTORES
CONDUCTORES	HILO DE COBRE ESTAÑADO, TRENZADO DE SECCIÓN 1,31 mm^2		
AISLAMIENTO	PVC (0,4 mm DE ESPESOR) Y PARA 75º DE TEMPERATURA COMO MÍNIMO	COLOR	VERDE, NEGRO, BLANCO
TRENZADO CADA PAR	CADA 50 mm	TRENZADO TOTAL	
PANTALLA POR POR	CINTA DE ALUMINIO/MYLAR APLICADA EN HÉLICE CON UN 25 % DE SOLAPE MÍNIMO, CON HILO DE DRENAJE DE COBRE FLEXIBLE Y ESTAÑADO DE 0,5 mm^2, EN CONTINUO CONTACTO CON EL ALUMINIO		
PAR DE COMUNICACIÓN		COLOR	
ENVOLTURA INTERNA	PVC (0,5 mm DE ESPESOR) Y PARA 75º DE TEMPERATURA COMO MÍNIMO	COLOR	VERDE
FUNDA			
ARMADURA	ALAMBRE DE ACERO RECOCIDO GALVANIZADO DE ∅ 0,6 mm CON RECUBRIMIENTO MÍNIMO DE UN 90 % NÚMERO DE HILOS 41		
ENVOLTURA EXTERNA	PVC (1,14 mm DE ESPESOR) Y PARA 75º DE TEMPERATURA COMO MÍNIMO	COLOR	VERDE
DIÁMETRO EXTERIOR		DIÁM. BAJO ARMADURA	
IDENTIFICACION DEL CABLE		PLACAS IDENTIFI-CACIÓN	DE ALUMINIO EN LOS TERMINALES Y CADA 10 m (NOTA 1)
PRENSAS	DE LATÓN CADMIADO, DOBLE SELLO, A PRUEBA DE INTEMPERIE, ROSCA NPT, FUNDA EXTERIOR DE PVC		

NOTA 1: La identificación será realizada por el Subcontratista de Montaje.

NOTA 2: Para multicables ver la especificación 1C.
No llevar señales de termorresistencia en el mismo multicable que leva señales analógicas de alto nivel.
* Máxima longitud disponible: 500 m

ESPECIFICACIÓN 1.C. - SEÑALES ANALÓGICAS DE ALTO NIVEL Y SEÑAL DE TERMORRESISTENCIA

SERVICIO	SEÑALES ANALÓGICAS ALTO NIVEL (24 D.C., 4- 20 mA) Y SEÑALES DE TERMORRESISTENCIA (NOTA 1)		
RUTA	ENTERRADO (AREAS DE PROCESO)	TIPO	MULTICABLES 12 PARES MULTICABLES 24 PARES
CONDUCTORES	COBRE FLEXIBLE DE 0,52 mm^2		
AISLAMIENTO	PVC (0,4 mm DE ESPESOR) Y PARA 75º DE TEMPERATURA COMO MÍNIMO	COLOR	UNO VERDE, UNO AZUL
TRENZADO CADA POR	CADA 50 mm	TRENZADO TOTAL	12 PARES = 166 mm 24 PARES = 288 mm
PANTALLA POR POR	CINTA DE ALUMINIO/MYLAR APLICADA EN HÉLICE CON UN 25 % DE SOLAPE MÍNIMO, CON HILO DE DRENAJE DE COBRE FLEXIBLE Y ESTAÑADO DE 0,5 mm^2, EN CONTINUO CONTACTO CON EL ALUMINIO.		
PAR DE COMUNICACIÓN	UN PAR DE 0,65 mm^2 CUBIERTO DE PVC	COLOR	NEGRO Y BLANCO
ENVOLTURA INTERNA	PVC (1,5 mm DE ESPESOR) Y PARA 75º DE TEMPERATURA COMO MÍNIMO	COLOR	AZUL
FUNDA			
ARMADURA	PARA 12 PARES: ALAMBRES DE ACERO 1 mm RECOCIDO Y GALVANIZADO 24 ALAMBRES. PARA 24 PARES: ALAMBRES DE ACERO 1,3 mm RECOCIDO. 24 ALAMBRES		
ENVOLTURA EXTERNA	PVC (1,7 mm DE ESPESOR) Y PARA 75º DE TEMPERATURA COMO MÍNIMO	COLOR	AZUL
DIÁMETRO EXTERIOR		DIÁM. BAJO ARMADURA	
IDENTIFICACION DEL CABLE	LOS PARES SE NUMERARAN CORRELATIVAMENTE DEL 1 AL 12 Ó DEL 1 AL 24 CADA 300 mm	PLACAS IDENTIFI-CACIÓN	DE PLOMO EN LOS EXTREMOS Y CADA 10 m (NOTA2)
PRENSAS	DE LATÓN CADMIADO, DOBLE SELLO, A PRUEBA DE INTEMPERIE, ROSCA NPT, FUNDA EXTERIOR DE PVC		

NOTA 1: No llevar en el mismo multicable señales de termorresistencias y señales analógicas de alto nivel

NOTA 2: Las identificación serán realizada por el Subcontratista de Montaje.

NOTA 3: Máxima resistencia: 30 Ω/km
Capacidad: 0,06 µF/km
Máxima Inductancia: 0,8 mH/km
Máxima longitud disponible: 12 pares = 300 mm
24 pares = 250 mm

ESPECIFICACIÓN 1.D. - SEÑALES DE TERMORRESISTENCIA

SERVICIO	SEÑALES DE TERMORRESISTENCIA.		
RUTA	AEREO (TODAS LAS AREAS)	TIPO	8 TERNAS
CONDUCTORES	COBRE RÍGIDO ESTANADO DE 0,52 mm^2		
AISLAMIENTO	PVC (0,4 mm DE ESPESOR) Y PARA 75º DE TEMPERATURA COMO MÍNIMO	COLOR	VERDE, NEGRO, BLANCO
TRENZADO CADA POR	CADA 50 mm	TRENZADO TOTAL	CADA 250 mm
PANTALLA POR POR	CINTA DE ALUMINIO/MYLAR APLICADA EN HÉLICE CON UN 25 % DE SOLAPE MÍNIMO, CON HILO DE DRENAJE DE COBRE FLEXIBLE Y ESTAÑADO DE 0,5 mm^2, EN CONTINUO CONTACTO CON EL ALUMINIO.		
PAR DE COMUNICACIÓN	UN PAR DE 0,65 mm^2 DE COBRE CUBIERTOS DE PVC	COLOR	BLANCO Y NEGRO
ENVOLTURA INTERNA	PVC (1,5 mm DE ESPESOR) Y PARA 75º DE TEMPERATURA COMO MÍNIMO	COLOR	VERDE
FUNDA			
ARMADURA	ALAMBRE DE ACERO RECOCIDO GALVANIZADO DE ∅ 1,0 mm CON RECUBRIMIENTO MÍNIMO DE UN 90 %		
ENVOLTURA EXTERNA	PVC (1,7 mm DE ESPESOR) Y PARA 75º DE TEMPERATURA COMO MÍNIMO	COLOR	VERDE
DIÁMETRO EXTERIOR		DIÁM. BAJO ARMADURA	
IDENTIFICACION DEL CABLE	LAS TERNAS SE NUMERARÁN DEL 1 AL 8 CORRELATIVAMENTE CADA 300 mm	PLACAS IDENTIFI-CACIÓN	DE PLOMO EN LOS EXTREMOS Y CADA 10 m (NOTA1)
PRENSAS	DE LATÓN CADMIADO, DOBLE SELLO, A PRUEBA DE INTEMPERIE, ½" NPT, FUNDA EXTERIOR DE PVC		

NOTA 1: Las placas de identificación serán colocadas por el Subcontratista de Montaje.
* Máxima longitud continua disponible: 700 m

ESPECIFICACIÓN 2.A. - SEÑALES DE ANALÓGICAS BAJO NIVEL (TERMOPARES TIPO K)

SERVICIO	SEÑALES ANALÓGICAS BAJO NIVEL (TERMOPARES TIPO K) DE SEGURIDAD INTRÍNSECA		
RUTA	AÉREO (TODAS LAS AREAS)	TIPO	DOS CONDUCTORES
CONDUCTORES (NOTA 1)	UNO RÍGIDO DE CHROMEL DE 1,31 mm^2 UNO RÍGIDO DE ALUMEL DE 1,31 mm^2		
AISLAMIENTO	PVC (0,4 mm DE ESPESOR) Y PARA 75º DE TEMPERATURA COMO MÍNIMO	COLOR	CHROMEL=AMARILLO ALUMEL=ROJO/AMARILLO
TRENZADO CADA POR	CADA 50 mm	TRENZADO TOTAL	
PANTALLA POR POR	CINTA DE ALUMINIO/MYLAR APLICADA EN HÉLICE CON UN 25 % DE SOLAPE MÍNIMO, CON HILO DE DRENAJE DE COBRE FLEXIBLE Y ESTAÑADO DE 0,5 mm^2, EN CONTINUO CONTACTO CON EL ALUMINIO (NOTA 2)		
PAR DE COMUNICACIÓN		COLOR	
ENVOLTURA INTERNA	PVC (0,5 mm DE ESPESOR) Y PARA 75º DE TEMPERATURA COMO MÍNIMO	COLOR	AMARILLO
FUNDA			
ARMADURA	ALAMBRE DE ACERO RECOCIDO GALVANIZADO DE ∅ 0,5 mm CON RECUBRIMIENTO MÍNIMO DE UN 90 %		
ENVOLTURA EXTERNA	PVC (0,75 mm DE ESPESOR) Y PARA 75º DE TEMPERATURA COMO MÍNIMO	COLOR	AZUL
DIÁMETRO EXTERIOR		DIÁM. BAJO ARMADURA	
IDENTIFICACION DEL CABLE		PLACAS IDENTIFI-CACIÓN	DE ALUMINIO EN LOS EXTREMOS Y CADA 10 m (NOTA 2)
PRENSAS	DE LATÓN CADMIADO, DOBLE SELLO, A PRUEBA DE INTEMPERIE, ROSCA NPT, FUNDA EXTERIOR DE PVC		

NOTA 1: Las características de los conductores cumplirán con la relación temperatura/f.e.m. para termopares tipo "K"

NOTA 2: Las placas de identificación serán colocadas por el Subcontratista de Montaje.

NOTA 3: Máxima resistencia: 30 Ω/km
Máxima Capacidad: 0,06 µF/km
Máxima Inductancia: 2mH/km
* Máxima longitud continua disponible: 500 m

ESPECIFICACIÓN 2.B. - SEÑALES DE ANALÓGICAS BAJO NIVEL (TERMOPARES TIPO K)

SERVICIO	SEÑALES ANALÓGICAS DE BAJO NIVEL (TERMOPARES TIPO K) DE SEGURIDAD INTRÍNSECA		
RUTA	ENTERRADO (AREAS DE PROCESO)	TIPO	MULTICABLES 12 PARES MULTICABLES 24 PARES
CONDUCTORES	UNO RÍGIDO DE CHROMEL DE 0,52 mm^2 UNO RÍGIDO DE ALUMEL DE 0,52 mm^2 (NOTA 3)		
AISLAMIENTO	PVC (0,4 mm DE ESPESOR) Y PARA 75º DE TEMPERATURA COMO MÍNIMO	COLOR	AMARILLO ROJO/AMARILLO
TRENZADO CADA POR	CADA 50 mm	TRENZADO TOTAL	CADA 166 mm
PANTALLA POR POR	DE ALUMINIO CUBRIENDO EL 100%, DE 0,1 mm DE ESPESOR, CON HILO DE DRENAJE DE COBRE ∅ 0,5 mm.	PANTALLA GENERAL	DE ALUMINIO CUBRIENDO EL 100%, DE 0,125 mm DE ESPESOR, CON HILO DE DRENAJE DE COBRE ∅ 0,5 mm.
PAR DE COMUNICACIÓN	UN PAR DE COBRE RÍGIDO DE ∅ 0,8 mm CUBIERTO DE PVC	COLOR	BLANCO Y NEGRO
ENVOLTURA INTERNA	PVC (1,5 MM DE ESPESOR) Y PARA 75º DE TEMPERATURA COMO MÍNIMO	COLOR	AMARILLO
FUNDA			
ARMADURA	ALAMBRES DE ACERO RECOCIDO GALVANIZADO RECUBR. UN MÍNIMO DEL 90% PARA 12 PARES: ∅ 1,0 mm PARA 24 PARES: ∅ 1,5 mm		
ENVOLTURA EXTERNA	PVC (1,7 mm DE ESPESOR) Y PARA 75º DE TEMPERATURA COMO MÍNIMO	COLOR	AZUL
DIÁMETRO EXTERIOR		DIÁM. BAJO ARMADURA	
IDENTIFICACION DEL CABLE	LOS PARES SE NUMERARAN CORRELATIVAMENTE DEL 1 AL 12 Ó DEL 1 AL 24 CADA 300 mm	PLACAS IDENTIFI-CACIÓN	DE PLOMO CADA 10 m Y EN LOS EXTREMOS (NOTA 1)
PRENSAS	DE LATÓN CADMIADO, DOBLE SELLO, A PRUEBA DE INTEMPERIE, ROSCA NPT, FUNDA EXTERIOR DE PVC		

NOTA 1: La identificación será realizada por el Subcontratista de Montaje.

NOTA 2: Máxima Resistencia: 30 Ω/km
Máxima Capacidad: 0,06 µF/km
Máxima Inductancia: 2 mH/km

NOTA 3: Las características de los conductores cumplirán con la relación temperatura/f.e.m. para termopares tipo "K"
Máxima longitud disponible: 12 pares = 300 mm / 24 pares = 250 mm

ESPECIFICACIÓN 2.C. - SEÑALES DE ANALÓGICAS BAJO NIVEL (TERMOPARES TIPO J)

SERVICIO	SEÑALES ANALÓGICAS DE BAJO NIVEL (TERMOPARES TIPO J) DE SEGURIDAD INTRÍNSECA		
RUTA	AÉREO (TODAS LAS AREAS)	TIPO	DOS CONDUCTORES
CONDUCTORES (NOTA 1)	UNO RÍGIDO EN HIERRO DE 1,31 mm^2 UNO RÍGIDO EN CONSTANTAN DE 1,31 mm^2		
AISLAMIENTO	PVC (0,4 mm DE ESPESOR) Y PARA 75º DE TEMPERATURA COMO MÍNIMO	COLOR	HIERRO = BLANCO CONSTANTAN= ROJO/BLANCO
TRENZADO CADA POR	CADA 50 mm	TRENZADO TOTAL	
PANTALLA POR POR	CINTA DE ALUMINIO/MYLAR APLICADA EN HÉLICE CON UN 25 % DE SOLAPE MÍNIMO, CON HILO DE DRENAJE DE COBRE FLEXIBLE Y ESTAÑADO DE 0,5 mm^2, EN CONTINUO CONTACTO CON EL ALUMINIO (NOTA 2)		
PAR DE COMUNICACIÓN		COLOR	
ENVOLTURA INTERNA	PVC (0,5 mm DE ESPESOR) Y PARA 75º DE TEMPERATURA COMO MÍNIMO	COLOR	BLANCO
FUNDA			
ARMADURA	ALAMBRE DE ACERO RECOCIDO GALVANIZADO DE ∅ 0,5 mm CON RECUBRIMIENTO MÍNIMO DE UN 90 %		
ENVOLTURA EXTERNA	PVC (0,75 mm DE ESPESOR) Y PARA 75º DE TEMPERATURA COMO MÍNIMO	COLOR	AZUL
DIÁMETRO EXTERIOR		DIÁM BAJO ARMADURA	
IDENTIFICACION DEL CABLE		PLACAS IDENTIFI-CACIÓN	DE ALUMINIO EN LOS EXTREMOS Y CADA 10 m (NOTA 2)
PRENSAS	DE LATÓN CADMIADO, DOBLE SELLO, A PRUEBA DE INTEMPERIE, ½ " NPT, FUNDA EXTERIOR DE PVC		

NOTA 1: Las características de los conductores cumplirán con la relación temperatura/f.e.m. para termopares tipo "J"

NOTA 2: Las placas de identificación serán colocadas por el Subcontratista de Montaje.

NOTA 3: Máxima resistencia: 30 Ω/km
Máxima Capacidad: 0,06 µF/km
Máxima Inductancia: 2mH/km
* Máxima longitud disponible: 500 m

ESPECIFICACIÓN 2.D. - SEÑALES DE ANALÓGICAS BAJO NIVEL (TERMOPARES TIPO J)

SERVICIO	SEÑALES ANALÓGICAS DE BAJO NIVEL (TERMOPARES TIPO J) DE SEGURIDAD INTRÍNSECA		
RUTA	AÉREO (TODAS LAS AREAS)	TIPO	MULTICABLES 12 PARES MULTICABLES 24 PARES
CONDUCTORES	UNO RÍGIDO EN HIERRO DE 0,52 mm^2 UNO RÍGIDO EN CONSTANTAN DE 0,52 mm^2 (NOTA 3)		
AISLAMIENTO	PVC (0,4 mm DE ESPESOR) Y PARA 75º DE TEMPERATURA COMO MÍNIMO	COLOR	HIERRO = BLANCO CONSTANTAN= ROJO/BLANCO
TRENZADO CADA PAR	CADA 50 mm	TRENZADO TOTAL	CADA 166 mm
PANTALLA POR POR	DE ALUMINIO CUBRIENDO EL 100%, DE 0,1 MM DE ESPESOR, CON HILO DE DRENAJE DE COBRE DE 0,5 mm. ∅	PANTALLA GENERAL	DE ALUM. CUBRIENDO EL 100%, DE 0,125 MM DE ESPESOR, CON HILO DE DRENAJE DE COBRE DE 0,5 mm. ∅
PAR DE COMUNICACIÓN	UN PAR DE COBRE RÍGIDO DE ∅ 0,8 mm CUBIERTO DE PVC	COLOR	BLANCO Y NEGRO
ENVOLTURA INTERNA	PVC (1,5 MM DE ESPESOR) Y PARA 75º DE TEMPERATURA COMO MÍNIMO	COLOR	AMARILLO
FUNDA			
ARMADURA	ALAMBRES DE ACERO RECOCIDO GALVANIZADO RECUBR. UN MÍNIMO DEL 90% PARA 12 PARES: ∅ 1,0 mm PARA 24 PARES: ∅ 1,5 mm		
ENVOLTURA EXTERNA	PVC (1,7 mm DE ESPESOR) Y PARA 75º DE TEMPERATURA COMO MÍNIMO	COLOR	AZUL
DIÁMETRO EXTERIOR		DIÁM. BAJO ARMADURA	
IDENTIFICACION DEL CABLE	LOS PARES SE NUMERARAN CORRELATIVAMENTE DEL 1 AL 12 Ó DEL 1 AL 24 CADA 300 mm	PLACAS IDENTIFI-CACIÓN	DE PLOMO EN LOS EXTREMOS Y CADA 10 m (NOTA 1)
PRENSAS	DE LATÓN CADMIADO, DOBLE SELLO, A PRUEBA DE INTEMPERIE, ROSCA NPT, FUNDA EXTERIOR DE PVC		

NOTA 1: La identificación será realizada por el Subcontratista de Montaje.

NOTA 2: Máxima Resistencia: 30 Ω/km
Máxima Capacidad: 0,06 µF/km
Máxima Inductancia: 2 mH/km

NOTA 3: Las características de los conductores cumplirán con la relación temperatura/f.e.m. para termopares tipo "J"
Máxima longitud disponible: 12 pares = 300 mm
24 pares = 250 mm

ESPECIFICACIÓN 3.A. -SEÑALES DE ANUNCIADORES DE ALARMAS (24 VDC/mA SOLO)

SERVICIO	SEÑALES A ANUNCIADORES DE ALARMAS (24 VDC/mA SOLO)		
RUTA	AÉREO (TODAS LAS AREAS)	TIPO	DOS CONDUCTORES
CONDUCTORES	COBRE ESTAÑADO TRENZADO DE 1,31 mm^2		
AISLAMIENTO	PVC (0,4 mm DE ESPESOR) Y PARA 75º DE TEMPERATURA COMO MÍNIMO	COLOR	AMARILLO (NEGATIVO) NARANJA (POSITIVO)
TRENZADO CADA PAR	CADA 50 mm	TRENZADO TOTAL	
PANTALLA POR POR	CINTA DE ALUMINIO/MYLAR APLICADA EN HÉLICE CON UN 25 % DE SOLAPE MÍNIMO, CON HILO DE DRENAJE DE COBRE FLEXIBLE Y ESTAÑADO DE 0,5 mm^2, EN CONTINUO CONTACTO CON EL ALUMINIO (NOTA 2)		
PAR DE COMUNICACIÓN		COLOR	
ENVOLTURA INTERNA	PVC (0,5 mm DE ESPESOR) Y PARA 75º DE TEMPERATURA COMO MÍNIMO	COLOR	NARANJA
FUNDA			
ARMADURA	ALAMBRE DE ACERO RECOCIDO GALVANIZADO DE ∅ 0,5 mm CON RECUBRIMIENTO MÍNIMO DE UN 90 %		
ENVOLTURA EXTERNA	PVC (1,7 MM DE ESPESOR) Y PARA 75º DE TEMPERATURA COMO MÍNIMO	COLOR	NARANJA
DIÁMETRO EXTERIOR		DIÁM. BAJO ARMADURA	MÍNIMO : 10 mm MÁXIMO: 11 mm
IDENTIFICACION DEL CABLE		PLACAS IDENTIFI-CACIÓN	DE ALUMINIO EN LOS EXTREMOS Y CADA 10 m (NOTA 1)
PRENSAS	DE LATÓN CADMIADO, DOBLE SELLO, A PRUEBA DE INTEMPERIE, ROSCA NPT, FUNDA EXTERIOR DE PVC		

NOTA 1: La identificación será realizada por el Subcontratista de Montaje.

NOTA 2: Máxima resistencia: 30 Ω/km
Máxima Capacidad: 0,1 µF/km
Máxima Inductancia: 3mH/km

- Máxima longitud disponible:
  12 pares = 300 m
  24 pares = 250 m

ESPECIFICACIÓN 3.B. -SEÑALES DE ANUNCIADORES DE ALARMAS (24 VDC/mA SOLO)

SERVICIO	SEÑALES A ANUNCIADORES DE ALARMAS (24 VDC/MA SOLO)		
RUTA	AÉREO (TODAS LAS AREAS)	TIPO	MULTICABLE 12 PARES MULTICABLE 24 PARES
CONDUCTORES	COBRE RÍGIDO ELECTROLITO RECOCIDO DE 0,52 mm^2		
AISLAMIENTO	PVC (0,4 mm DE ESPESOR) Y PARA 75º DE TEMPERATURA COMO MÍNIMO	COLOR	AMARILLO (NEGATIVO) NARANJA (POSITIVO)
TRENZADO CADA POR	CADA 50 mm	TRENZADO TOTAL	12 PARES: 166 mm 24 PARES: 288 mm
PANTALLA POR POR	CINTA DE ALUMINIO/MYLAR APLICADA EN HÉLICE CON UN 25 % DE SOLAPE MÍNIMO, CON HILO DE DRENAJE DE COBRE FLEXIBLE Y ESTAÑADO DE 0,5 mm^2, EN CONTINUO CONTACTO CON EL ALUMINIO (NOTA 2)		
PAR DE COMUNICACIÓN	UN PARA DE CONDUCTOR DE COBRE 0,65 mm^2 CUBIERTOS DE PVC	COLOR	BLANCO Y NEGRO
ENVOLTURA INTERNA	PVC (1,5 mm DE ESPESOR) Y PARA 75º DE TEMPERATURA COMO MÍNIMO	COLOR	NARANJA
FUNDA			
ARMADURA	ALAMBRE DE ACERO RECOCIDO GALVANIZADO DE 1,0 mm ∅ CON RECUBRIMIENTO MÍNIMO DEL 90 % PARA 12 PARES Y DE 1,3 mm ∅ PARA 24 PARES		
ENVOLTURA EXTERNA	PVC (1,7 mm DE ESPESOR) Y PARA 75º DE TEMPERATURA COMO MÍNIMO	COLOR	NARANJA
DIÁMETRO EXTERIOR		DIÁM. BAJO ARMADURA	MÍNIMO : 10 mm MÁXIMO: 11 mm
IDENTIFICACION DEL CABLE		PLACAS IDENTIFI-CACIÓN	DE ALUMINIO EN LOS TERMINALES Y CADA 10 M (NOTA 1)
PRENSAS	DE LATÓN CADMIADO, DOBLE SELLO, A PRUEBA DE INTEMPERIE, ROSCA NPT, FUNDA EXTERIOR DE PVC		

NOTA 1: La identificación será realizada por el Subcontratista de Montaje.

NOTA 2: Máxima resistencia: 30 Ω/km
Máxima Capacidad: 0,1 µF/km
Máxima Inductancia: 3mH/km

- Máxima longitud disponible:
  12 pares = 300 m
  24 pares = 250 m

ESPECIFICACIÓN 4.A. - ALIMENTACIÓN INSTRUMENTOS

SERVICIO	ALIMENTACIÓN INSTRUMENTOS (110 VAC PARA SOLENOIDES, INSTRUMENTOS DE CAMPO, ETC.)		
RUTA	AÉREO (TODAS LAS AREAS)	TIPO	UN PAR
CONDUCTORES	COBRE RÍGIDO ESTAÑADO DE 2,5 mm^2		
AISLAMIENTO	PVC (0,8 mm DE ESPESOR)	COLOR	UN CONDUCTOR VERDE UN CONDUCTOR GRIS
TRENZADO CADA PAR	CADA 50 mm	TRENZADO TOTAL	
PANTALLA POR POR		SEPARADOR TOTAL	NO HIGROSCAPICO CON CINTA DE MYLAR
PAR DE COMUNICACIÓN		COLOR	
ENVOLTURA INTERNA	PVC (0,8 mm DE ESPESOR)	COLOR	GRIS
FUNDA			
ARMADURA	ALAMBRE DE ACERO RECOCIDO GALVANIZADO DE ∅ 0,5 mm CON RECUBRIMIENTO MÍNIMO DE UN 90 %		
ENVOLTURA EXTERNA	PVC 1,2 mm DE ESPESOR	COLOR	GRIS
DIÁMETRO EXTERIOR		DIÁM. BAJO ARMADURA	
IDENTIFICACION DEL CABLE		PLACAS IDENTIFI-CACIÓN	DE ALUMINIO EN LOS EXTREMOS Y CADA 10 m (NOTA 1)
PRENSAS	DE LATÓN CADMIADO, DOBLE SELLO, A PRUEBA DE INTEMPERIE, ROSCA NPT, FUNDA EXTERIOR DE PVC		

NOTA 1: La identificación será realizada por el Subcontratista de Montaje.

NOTA 2: El tamaño del conductor será determinado según la corriente de trabajo.
Máxima caída de tensión 0,5 voltios (sección mínima 2,5 mm^2)
* Máxima longitud disponible: 500 m

ESPECIFICACIÓN 4.B. - ALIMENTACIÓN INSTRUMENTOS

SERVICIO	ALIMENTACIÓN INSTRUMENTOS DE 110 VAC PARA DISPAROS SOLENOIDES, OTROS INSTRUMENTOS DE CAMPO. (NOTA 1)		
RUTA	ENTERRADO (ÁREAS DE PROCESO)	TIPO	12 PARES
CONDUCTORES	COBRE RÍGIDO ESTAÑADO DE 2,5 mm^2 (NOTA 2)		
AISLAMIENTO	PVC (0,8 mm DE ESPESOR)	COLOR	UN CONDUCTOR VERDE UN CONDUCTOR GRIS
TRENZADO CADA PAR	CADA 50 mm	TRENZADO TOTAL	CADA 250 mm
PANTALLA POR POR		SEPARADOR TOTAL	NO HIGROSCÓPICO CON CINTA DE MYLAR
PAR DE COMUNICACIÓN	UN PAR DE CONDUCTORES DE COBRE DE 0,65 mm	COLOR	BLANCO Y NEGRO
ENVOLTURA INTERNA	PVC (0,8 mm DE ESPESOR)	COLOR	GRIS
FUNDA			
ARMADURA	ALAMBRE DE ACERO RECOCIDO GALVANIZADO DE ∅ 0,6 mm CON RECUBRIMIENTO MÍNIMO DE UN 90 %		
ENVOLTURA EXTERNA	PVC 1,7 mm DE ESPESOR	COLOR	GRIS
DIÁMETRO EXTERIOR		DIÁM. BAJO ARMADURA	
IDENTIFICACION DEL CABLE	CADA PAR NUMERADO DEL 1 AL 12 CADA 300 mm	PLACAS IDENTIFI-CACIÓN	DE PLOMO CADA 10 m Y EN EXTREMOS (NOTA 3)
PRENSAS	DE LATÓN CADMIADO, DOBLE SELLO, A PRUEBA DE INTEMPERIE, ROSCA NPT, FUNDA EXTERIOR DE PVC		

NOTA 1: Este cable alimentará 110 VAC desde el sistema de alimentación en Sala de Control hasta instrumentos en campo.

NOTA 2: El tamaño del conductor será determinado según la corriente de trabajo. Máxima caída de tensión 0,5 voltios (sección mínima 2,5 mm^2)

NOTA 2: La identificación será realizada por el Subcontratista de Montaje.
* Máxima longitud disponible: 500 m

INT ET 021/2006

PRESSURE TRANSMITTERS
TECHNICAL SPECIFICATION

REV.	FECHA	DESCRIPCION	PREPARADO POR	APROBADO POR

INDICE DE REVISIONES

PÁGINA	REVISIÓN	FECHA

1. SCOPE

This Technical Specification establishes the general requirements for the supply of Electronic Process Pressure Transmitters.

2. APPLICABLE DOCUMENTATION

When applicable, the last edition of the following codes and standards shall be considered:

- ASTM - American Society for Testing and Materials
- ANSI - American National Standard Institute
  - ANSI B1.20.1 Connection Threads (NPT).
  - ANSI B16.5 Fanged connections.
- ISA - Instrument Society of America
- NEMA - National Electrical Manufacturers Association
- AISI - American Iron and Steel Institute
- ASME - American Society of Mechanical Engineers
- FM - Factory Mutual USA

3. GENERAL CHARACTERISTICS

A. The electronic transmitters shall be smart, 4-20 mA / digital output, capable of communicating digitally with the existing DCS.
B. The transmitters shall have a local LCD indicator. The indicator shall display the measured variable in engineering units.
C. They shall have temperature and static pressure compensation.
D. They shall support remote calibration.
E. The electronic transmitters shall be suitable for operating in FM certified intrinsic safe loops. The safety barrier is not included in the supplier's scope. The supplier shall inform the barrier type to be used and the "entity parameters" certified by FM.
F. The transmitter shall support a remote local indicator (outside scope of supply) anytime when is required to operate a remote valve . The supplier shall inform the manufacture and model that shall be used in order that intrinsic safe certification results not affected.
G. The case shall be weatherproof and watertight NEMA 4.
H. Transmitters shall powered through an intrinsically safe barrier from the control system input cards (DCS, ESDS) with 24/30 VDC power voltage.
I. The accuracy shall be ± 0.2 % of the instrument span, or better.
J. All necessary elements for 2" pipe mounting (yoke) shall be included.
K. Process pressure will actuate directly on the sensing element (capacitive, resonant wire, piezoelectric, or similar). Mechanical links introducing hysteresis or other errors won't be allowed.
L. For working pressures bellow atmospheric pressure transmitters shall support absolute vacuum without damage or loss of calibration.
M. Transmitter bodies, cells and sensors may work under static pressures determined by the rating without affecting the operating parameters.
N. All transmitter bodies shall have vents and drain with plugs (NPT).

O. The body material shall be as indicated in the attached data sheets. The sensor material, in contact with the process, will be AISI 316, HASTELLOY C, or better. All the assembly shall be suitable for the operating conditions detailed in the data sheets.
P. All threaded connections shall be by ANSI standard B1.20.1 (NPT).
Q. All elements shall be treated thermally and subjected to remnant stress relief to minimize hysteresis.
R. All transmitters shall be supplied with a junction box, with a 1/2" NPT electric connection. In case of a second electric connection, it shall be provided with a bronze plug.
S. Local Zero and span adjustments may be done locally.
T. Main operating parameters shall be indicated in the offer: Accuracy, repeatability, hysteresis and dead band. Calibration stability over the time, output deviations due to operating temperature changes and voltage supply required shall also be indicated.
U. Instrument span adjustment turndown shall be 6 (six) or higher.
V. Transmitters shall have a high common mode rejection ratio and high immunity to electrical noise (RFI and EMI).
W. The sensing elements shall be protected for overpressures of 1.3 times the operating pressure.
X. All transmitters shall be suitable to operate in a salt laden marine weather atmosphere.

	1	TAG No.							
	2	SERVICE / LOCATION							
	3	P & I							
GENERAL	4	FUNCTION							
	5	CASE: SIZE	COLOR	*BY MANUFACTURER*	*STD. MANUFACTURER*				
	6	MOUNTING		*2" FOR PIPE MOUNTING (YOKE)*					
	7	AREA CLASS.							
	8	ENCLOSURE CLASS		*NEMA 4*					
	9	POWER SUPPLY		*24/30 V dc ,*					
	10	CHART: SIZE	SCALE						
		DRIVE	SPEED						
	11	No. POINTS INDIC.	REGISTER						
	12	SCALE TYPE							
	13	RANGE							
	13	TOTAL ALLOWABLE ERROR (1)							
X	14	OUTPUT SIGNAL TRANSMITTER		*4- 20 mA / DIGITAL / DE PROTOCOL*					
CONTROL	15	CONTROL MODES							
	16	ON MEAS. INCREASE OUTPUT							
	17	SELECT. AUTO / MANUAL							
	18	ADJ.SET-POINT	REMOTE	SELECT. L/R				--	--
	19								
ELEMENT	20	MEAS. TYPE							
	21	ELEMENT TYPE		*DIAPHRAGM*					
	22	MATERIAL: BODY	ELEMENT	*C.S.*	*AISI 316*				
	23	MAX. STATIC PRESSURE (KG/cm2)							
	24	ADJUSTED RANGE (kg/cm²)							
	25	FIXED	ADJUSTABLE (mmH_2O)		*YES*				
	26	ELECTRICAL CONNECTION		*½" NPT*					
	27	PROCESS CONN.	LOCATION	*½" NPT F/ FANGED*					
OPTION	28	FILT. REG. / Lighting Protection		*/ yes*					
	29	OUTPUT INDICATOR		*YES, (smart meter)*					
	30	DIAPH. SEAL							
OPERATION	31	FLUID / fluid state							
	32	MAX. PRESS. (Kg/cm^2g)	NOR. PRESS. (Kg/cm^2g)						
	33	MÁX. TEMP. °C	NOR. TEMP. °C						
	34	MANUFACTURER							
	35	MODEL							

NOTES: (1) Maximum Meter body Temperature: 125 Celsius, to be considered in the Typical Hook-Ups

:

ARQUITECTURA DEL SISTEMA

FUENTE
TSX SUP 1021

220Vca

L

N

24V

0V

Q26F

+24 (24Vcc)

0

6A

(09 B)

CONSOLA
INTERFASE

MAGELIS XBT-P011010

PLC: TSX 3722001

TER

AUX

TSX DEZ 32D2 — 1

TSX DEZ 32D2 — 3

TSX DEZ 32D2 — 5

TSX DEZ 32D2 — 7

TSX DSZ 32R5 — 9

TSX DEZ 32D2 — 2

TSX DEZ 32D2 — 4

TSX DEZ 32D2 — 6

TSX DEZ 32D2 — 8

10

24 Vcc

0 Vcc

24Vcc

0Vcc

L

N

TSX SCP 114

RS485

X2-46

ALIMENTACION
220VCA
VER PL.N° 5487-801

X2-47

Degrémont
TRATAMIENTO DE AGUAS

PLANO N° :
5487 — 802 E
EJECUCION NUMERO REV.

Fecha : 14 / 08 /2001
Realizo : CASTAÑO
HOJA 3 DE 22 HOJAS

QUEDA PROHIBIDA LA REPRODUCCION
TOTAL O PARCIAL DE ESTE DOCUMENTO
SIN PREVIA AUTORIZACION ESCRITA.-
PROPIEDAD DE DEGREMONT S.A. -

DISK N°: 01 ARCHIVO: 5487-802-E hoja 1.dwg

DOCUMENTO CREADO POR ORDENADOR
FORMATO : 420 mm x 297 mm

A3

ALIMENTACION INSTRUMENTOS 220VCA			
FOSA RECOLECTORA ACEITE	FOSA RECOLECTORA ACEITE	CAUDAL RECICLO 1	CAUDAL RECICLO 2
LT81220	LT81244	FI81213	FI81242

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

−XC :1..12 — (220VCA) — (P1)

410 — 412 — :N :⏚ — :25 :26 — 413 — −FC2 2A — 411 — :13..24 −XC

410 — 414 — :N :⏚ — :28 :29 — 415 — −FC4 2A — 411

410 — 416 — :N :⏚ — :75 :76 — 417 — −FC6 2A — 411

410 — 418 — :N :⏚ — :78 :79 — 419 — −FC8 2A — 411

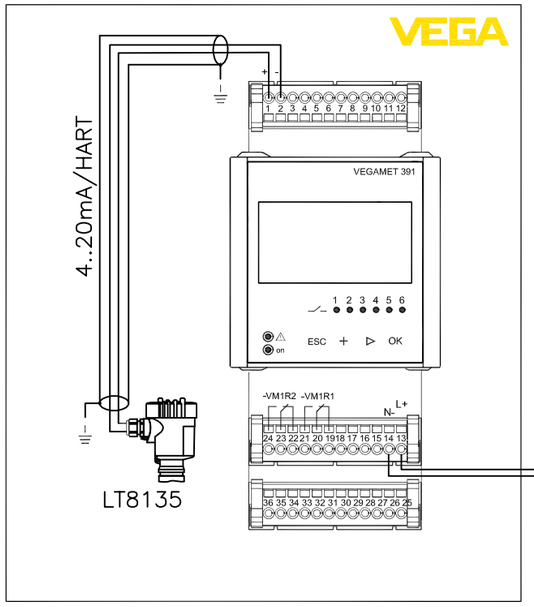
410 — 412 — :N :⏚ — :27 :30 — 413 — −FC1 2A — 411

410 — 414 — :N :⏚ — :77 :80 — 415 — −FC3 2A — 411

410 — 416 — :N :⏚ — :77 — 417 — −FC5 2A — 411

410 — 418 — :N :⏚ — :79 — 419 — −FC7 2A — 411

411 — (P2)



Q

6A

−VM1R2

NA	NC
12.17	

−VM1R1

NA	NC
12.16	

ALIMENTACION 220VCA
VER PL.Nº 5487-801

DISK Nº: 01 ARCHIVO: 5487-802-E hoja 1.dwg

DOCUMENTO CREADO POR ORDENADOR
FORMATO : 420 mm x 297 mm

QUEDA PROHIBIDA LA REPRODUCCION TOTAL O PARCIAL DE ESTE DOCUMENTO SIN PREVIA AUTORIZACION ESCRITA.- PROPIEDAD DE DEGREMONT S.A. -

Degrémont TRATAMIENTO DE AGUAS

PLANO Nº :			
5487	− 802	F	Fecha : 20 / 05 /2014
EJECUCION	NUMERO	REV.	Realizo : F.S.
			HOJA 4 DE 22 HOJAS

A3

SEÑALES DE CAMPO																																			
PREPARACION DE COAGULANTE							PREPARACION DE FLOCULANTE							PUENTE BARREDOR			BOMBA ELEVADORA PILETA API 8121-J				CIRCUITO AUXILIAR PARA													
LSL81202	LSL81203	SELECCION CUBA A	SELECCION CUBA B				LSL81204	LSL81205	SELECCION CUBA A	SELECCION CUBA B				XSH81206	LSL81207		ALTA TEMPERATURA		HUMEDAD		REPETICION	DETECCION DE HUMEDAD EN BBA. 8121-J											

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

-XC :1..12 (220VCA) (P1)

-FC9 2A | -FC10 2A | -FC11 2A | -FC12 2A

-QDH1 (*)

ALIMENTACION 220VCA
VER PL.Nº 5487-801

-X2 :1 :5 :9 :11 :13

+JB1 HS81202 | +JB2 HS81204 | +JB3 XSH | +JB9 TSH8121J

-KTH1 22 | -KHU1 29 | -KXH1 24

-X2 :15 +JB9 :3 :4 :9 M

-X2 :2 :3 :4 :6 :7 :8 :10 :12 :14

-KA1 -KA2 -KA3 -KA4 -KA5 -KA6 -KA7 -KA8 -KTH1 -KXH1 -KA9 -KHU1

-XC :13..24 (P2)

-KA1 NA	-KA1 NC	-KA2 NA	-KA2 NC	-KA3 NA	-KA3 NC	-KA4 NA	-KA4 NC	-KA5 NA	-KA5 NC	-KA6 NA	-KA6 NC	-KA7 NA	-KA7 NC	-KA8 NA	-KA8 NC	-KTH1 NA	-KTH1 NC	-KXH1 NA	-KXH1 NC	-KA9 NA	-KA9 NC	-KHU1 NA	-KHU1 NC
13.14 11.6		13.12 11.7	13.14	13.12 11.5		14.9 11.9		14.7 11.8		14.7 11.10	14.9	16.2 16.10 11.12		17.2 11.11		26 12.11		26 12.10		24		14.22	

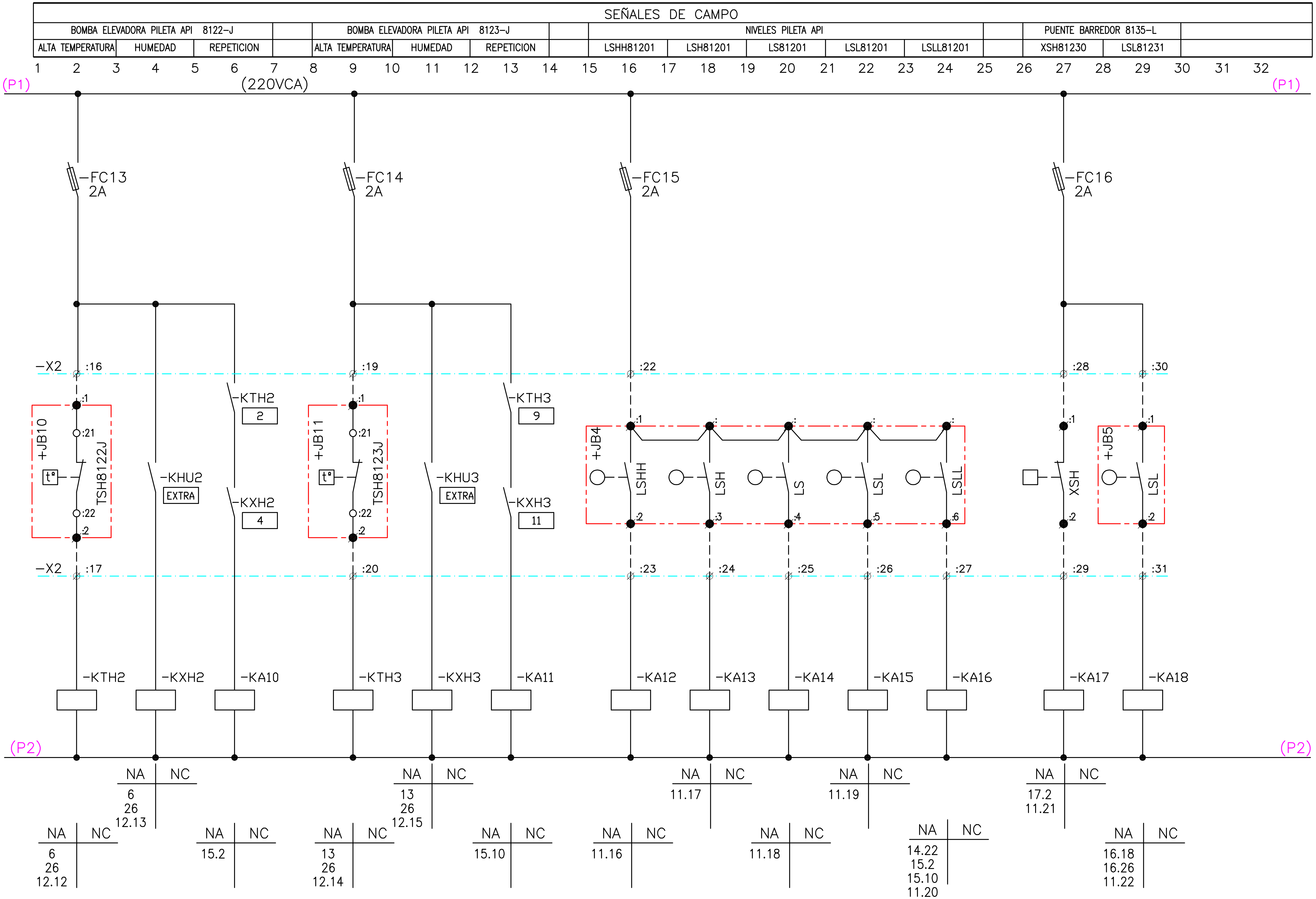
NOTAS: LOS BORNES o:21, o:22, o:9 CORRESPONDEN A LA BORNERA DEL MOTOR DE LA BOMBA
EL DISYUNTOR -QDH1 y EL RELE -KHU1 SE DEBERAN MONTAR EN UNA CAJA EN CAMPO O CABLEAR EN INTERIOR DEL TABLERO
EL DISYUNTOR -QDH1, DEBERA ESTAR CERRADO PARA UN CORRECTO FUNCIONAMIENTO DEL CIRCUITO DE DETECCION.

Degrémont TRATAMIENTO DE AGUAS

PLANO Nº :				
5487	–	802	E	Fecha : 10 / 10 /2001
EJECUCION		NUMERO	REV.	Realizo : CARAVANTE
				HOJA 5 DE 22 HOJAS

QUEDA PROHIBIDA LA REPRODUCCION TOTAL O PARCIAL DE ESTE DOCUMENTO SIN PREVIA AUTORIZACION ESCRITA.- PROPIEDAD DE DEGREMONT S.A. -

DOCUMENTO CREADO POR ORDENADOR
FORMATO : 420 mm x 297 mm
DISK Nº: 01 ARCHIVO: 5487-802-E.dwg
A3



QUEDA PROHIBIDA LA REPRODUCCION TOTAL O PARCIAL DE ESTE DOCUMENTO SIN PREVIA AUTORIZACION ESCRITA.- PROPIEDAD DE DEGREMONT S.A. -

DOCUMENTO CREADO POR ORDENADOR FORMATO : 420 mm x 297 mm

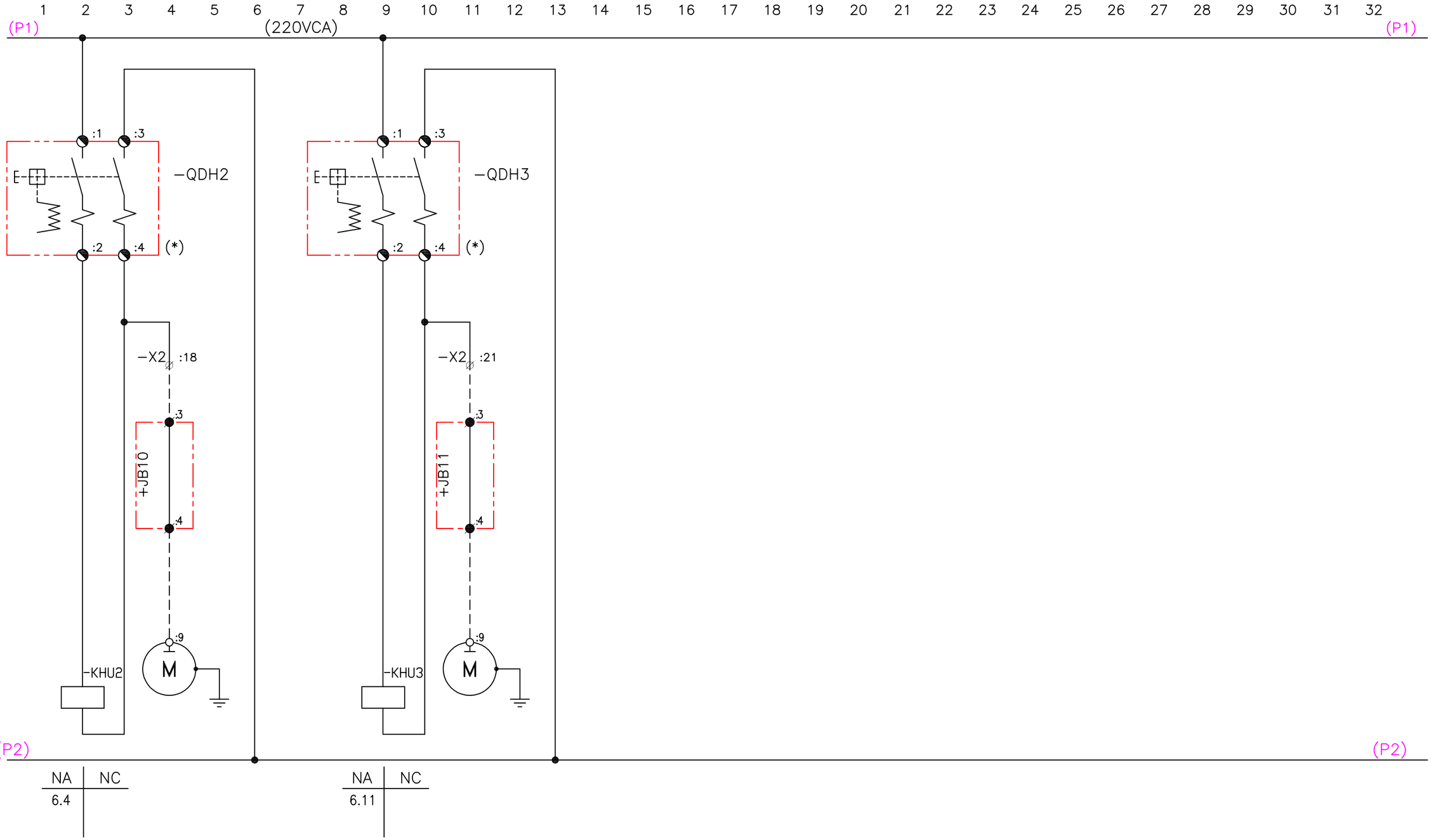
DISK N°: 01 ARCHIVO: 5487-802-E.dwg

Degrémont TRATAMIENTO DE AGUAS

PLANO N° :			Fecha : 10 / 10 /2001
5487	– 802	E	Realizo :CARAVANTE
EJECUCION	NUMERO	REV.	HOJA 6A DE 22 HOJAS

A3

SEÑALES DE CAMPO			
CIRCUITO AUXILIAR PARA DETECCION DE HUMEDAD EN BBA. 8122–J	CIRCUITO AUXILIAR PARA DETECCION DE HUMEDAD EN BBA. 8123–J		CIRCUITO AUXILIAR PARA DETECCION DE HUMEDAD



NOTAS: LOS BORNES o:21, o:22, o:9 CORRESPONDEN A LA BORNERA DEL MOTOR DE LA BOMBA
LOS DISYUNTORES –QDH2/QDH3, y LOS RELES –KHU2/KHU3, SE DEBERAN MONTAR EN UNA CAJA EN CAMPO O CABLEAR EN DEL TABLERO

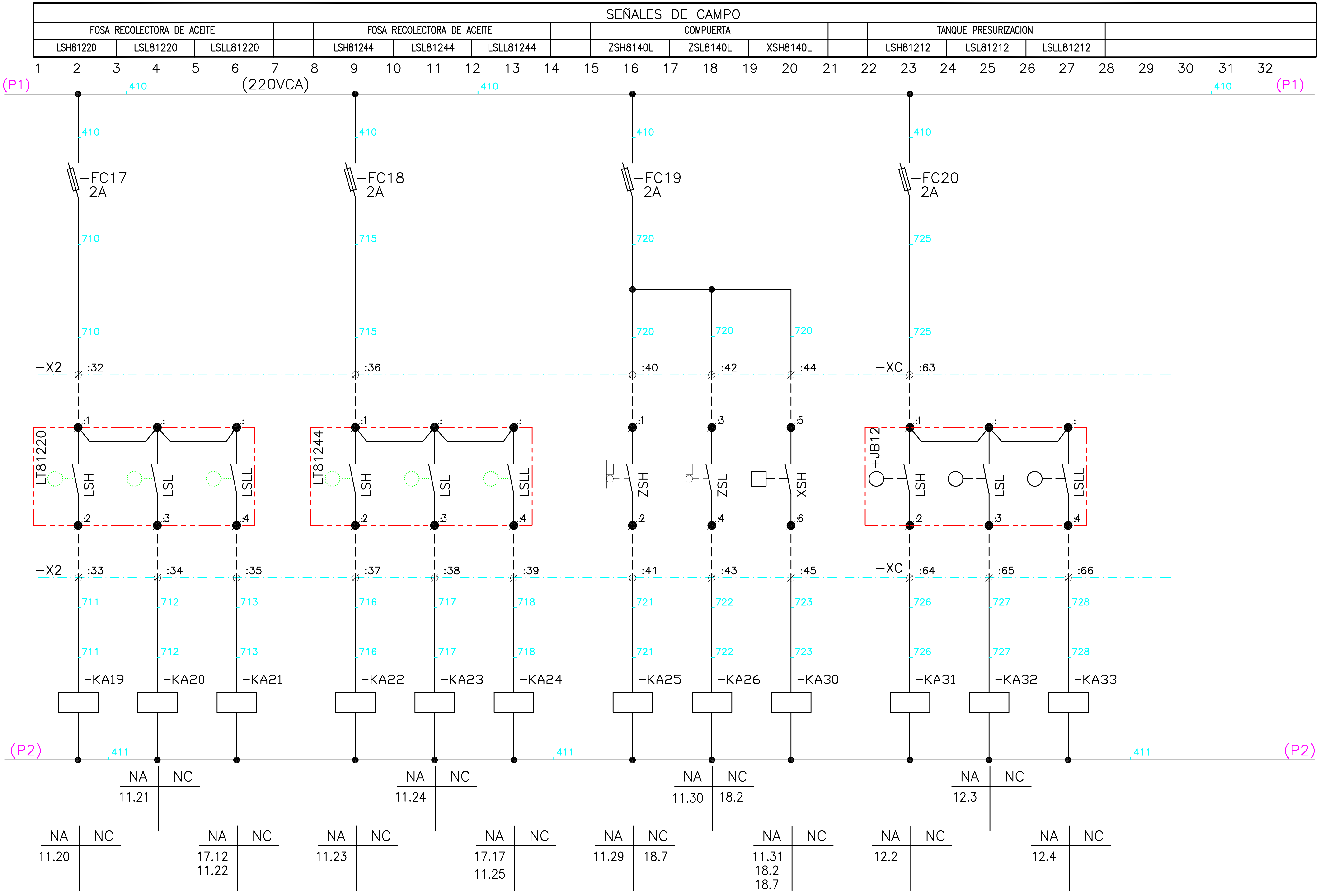
LOS DISYUNTORES –QDH2/QDH3, DEBERAN ESTAR CERRADOS PARA UN CORRECTO FUNCIONAMIENTO DE LOS CIRCUITOS DE DETECCION.

Degrémont
TRATAMIENTO DE AGUAS

PLANO N° :			
5487	– 802	E	Fecha : 10 / 10 /2001
EJECUCION	NUMERO	REV.	Realizo : CARAVANTE
			HOJA 6B DE 22 HOJAS

QUEDA PROHIBIDA LA REPRODUCCION TOTAL O PARCIAL DE ESTE DOCUMENTO SIN PREVIA AUTORIZACION ESCRITA. – PROPIEDAD DE DEGREMONT S.A. –

DOCUMENTO CREADO POR ORDENADOR
FORMATO : 420 mm x 297 mm
DISK N°: 01
ARCHIVO: 5487–802–E.dwg



PLANO Nº : 5487 – 802 E

EJECUCION NUMERO REV.

Fecha : 14 / 08 /2001

Realizo : CASTAÑO

HOJA 7 DE 22 HOJAS

Degrémont TRATAMIENTO DE AGUAS

A3

DISK Nº: 01 ARCHIVO: 5487-802-E hoja 1.dwg

DOCUMENTO CREADO POR ORDENADOR FORMATO : 420 mm x 297 mm

QUEDA PROHIBIDA LA REPRODUCCION TOTAL O PARCIAL DE ESTE DOCUMENTO SIN PREVIA AUTORIZACION ESCRITA.- PROPIEDAD DE DEGREMONT S.A. -

SEÑALES DE CAMPO						
TANQUE PRESURIZACION				BAJA PRESION AIRE		
LSH81236	LSL81236	LSLL81236		PSL81209	PSL81233	

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

(P1) 410 (220VCA) 410 410 (P1)

410 410 410

−FC21 2A −FC22 2A −FC23 2A

810 815 817

810 815 817

−XC :67 :71 :73

+JB13 :1 :3 :5 LSH LSL LSLL :2 :4 :6

−XC :68 :69 :70 :72 :74

811 812 813 816 818

811 812 813 816 818

−KA34 −KA35 −KA36 −KA37 −KA38

(P2) 411 411 411 (P2)

NA NC 12.6

NA NC 12.8

NA NC 12.5

NA NC 12.7

NA NC 12.9

QUEDA PROHIBIDA LA REPRODUCCION TOTAL O PARCIAL DE ESTE DOCUMENTO SIN PREVIA AUTORIZACION ESCRITA.- PROPIEDAD DE DEGREMONT S.A. -

DOCUMENTO CREADO POR ORDENADOR FORMATO : 420 mm x 297 mm DISK N°: 01 ARCHIVO: 5487-802-E hoja 1.dwg

Degrémont TRATAMIENTO DE AGUAS

PLANO N° : 5487 − 802 E

EJECUCION NUMERO REV.

Fecha : 14 / 08 /2001

Realizo : CASTAÑO

HOJA 8 DE 22 HOJAS

A3

SEÑAL DE SELECTORES EN AUTOMATICO																	CONFIRMACION DE MARCHA										
8128-J	8128-JA	8129-J	8129-JA	8121-J	8122-J	8123-J	8124-L	8125-L	8131-J	8131-JA	8136-J	8136-JA	8130-L	8135-L	8132-J		8137-J	8128-J	8128-JA	8129-J	8129-JA	8121-J	8122-J	8123-J	8124-L	8125-L	8131-J	8131-JA
-S3	-S4	-S7	-S8	-S9	-S10	-S11	-S12	-S13	-S14	-S15	-S16	-S17	-S18	-S19	-S20		-S21	-K3	-K4	-K7	-K8	-K9L	-K10L	-K11L	-K12	-K13	-K14L	-K15L

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

(03 B Q26F) (+24Vcc) +24 +24 +24 (+24Vcc)

(0Vcc) 0 0 0 (0Vcc)

13.20 13.25 14.15 14.20 14.25 15.5 15.13 15.21 15.32 16.5 16.13 16.21 16.29 17.5 17.10 17.15 +24 0 +24 17.20 +24 +24 +24 +24 +24 +24 +24 +24 +24 +24 +24 +24

1330 1340 1430 1440 1445 1520 1540 1550 1565 1620 1635 1650 1665 1715 1725 1735 +24 0 +24 1745 930 931 932 933 934 935 936 937 938 939 940

-XI :1 :2 :3 :4 :5 :6 :7 :8 :9 :10 :11 :12 :13 :14 :15 :16 :17 :18 :19 :20 :21 :22 :23 :24 :25 :26 :27 :28 :29 :30 :31

13.17 -K3 13.22 -K4 14.12 -K7 14.17 -K8 14.22 -K9L 15.2 -K10L 15.10 -K11L 15.18 -K12 15.29 -K13 16.2 -K14L 16.10 -K15L

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15				0	1	2	3	4	5	6	7	8	9	10	11

POSICIÓN 1 — POSICIÓN 2

TSX DEZ 32D2

ENTRADAS

SALIDAS

TSX DSZ 32R5

POSICIÓN 9 — POSICIÓN 10

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15				0	1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30

-XS :1 :2 :3 :4 :5 :6 :7 :8 :9 :10 :11 :12 :13 :14 :15 :16 :17 :18 :19

910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928

13.20 13.25 14.15 14.20 14.25 15.5 15.13 15.21 15.32 16.5 16.13 16.21 16.29 17.5 17.10 17.15 926 17.20 928

950 951 952 953 954 955 956 957 958 959 960

-XC :32 :35 :38 :41 :50 :47 :53 :56 :59 :44 :62

-HA

FC26 2A FC27 2A

-XC :31 :34 :37 :40 :49 :46 :52 :55 :58 :43 :61

410 970 970 970 971

220V 1..12 (P1) 410 410

-FC24 2A -FC25 2A

-XC :13..24 (P2) 411 411 411 411 (P2)

8128-J	8128-JA	8129-J	8129-JA	8121-J	8122-J	8123-J	8124-L	8125-L	8131-J	8131-JA	8136-J	8136-JA	8130-L	8135-L	8132-J	8137-J		RESERVA	YV 81216	YV 81217	YV 81240	YV 81241	YV 81215	YV 81218	YV 81239	YV 81242	YV 81243	YV 81219	ALARMA ACUSTICA
ORDENES DE MARCHA																			ORDENES APERTURA/CIERRE ELECTROVALVULAS										

Degrémont TRATAMIENTO DE AGUAS

PLANO N° : 5487 – 802 E

EJECUCION NUMERO REV.

Fecha : 14 / 08 /2001

Realizo :CASTAÑO

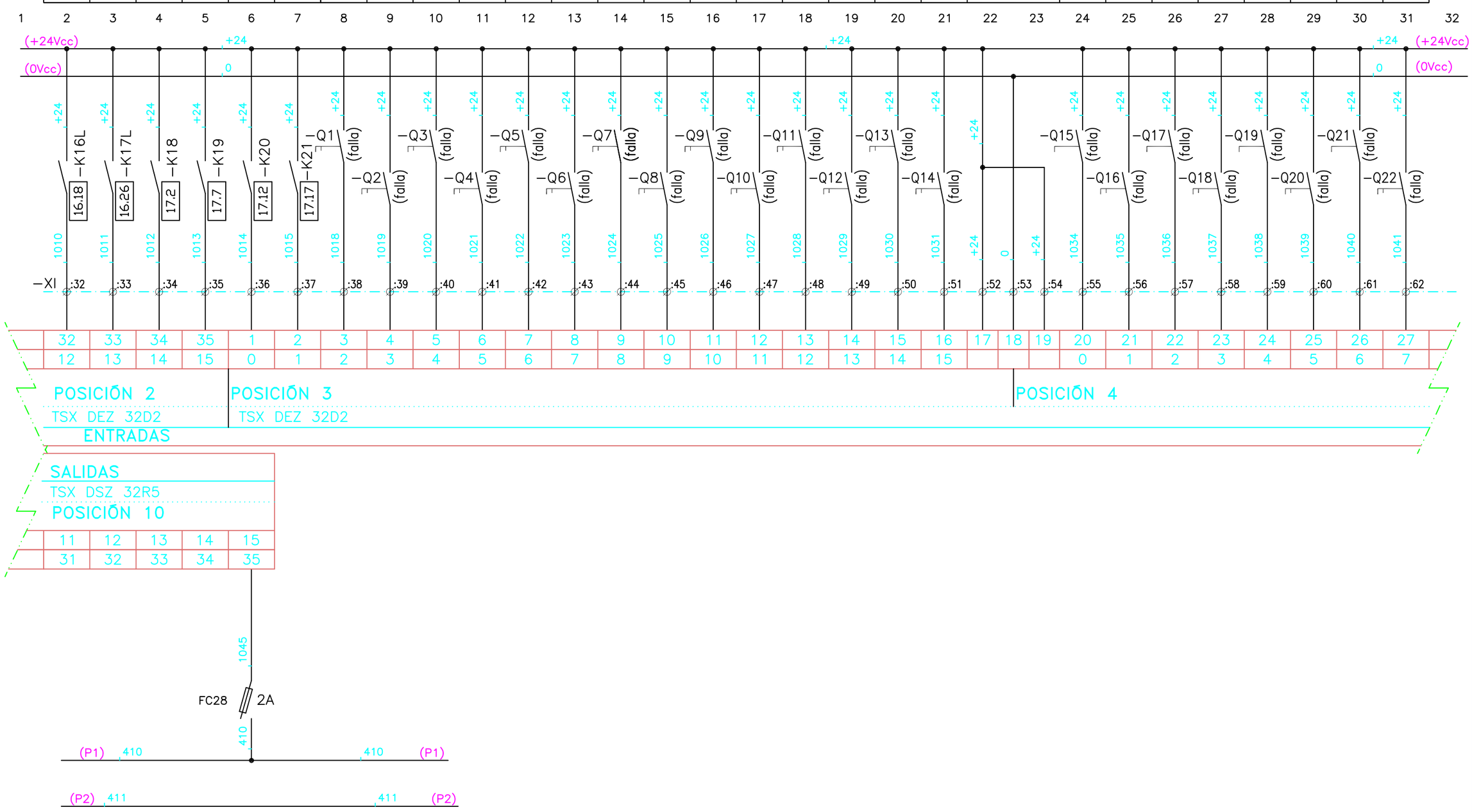
HOJA 9 DE 22 HOJAS

QUEDA PROHIBIDA LA REPRODUCCION TOTAL O PARCIAL DE ESTE DOCUMENTO SIN PREVIA AUTORIZACION ESCRITA.- PROPIEDAD DE DEGREMONT S.A. -

DOCUMENTO CREADO POR ORDENADOR FORMATO : 420 mm x 297 mm DISK N°: 01 ARCHIVO: 5487-802-E hoja 2.dwg

A3

CONFIRMACION DE MARCHA						FALLA ELECTRICA GUARDAMOTORES																							
8136–J	8136–JA	8130–L	8135–L	8132–J	8137–J	8126–L	8126–LA	8128–J	8128–JA	8127–L	8127–LA	8129–J	8129–JA	8121–J	8122–J	8123–J	8124–L	8125–L	8131–J		8131–JA	8136–J	8136–JA	8130–L	8135–L	8132–J	8137–J	8133–J
–K16L	–K17L	–K18	–K19	–K20	–K21	–Q1	–Q2	–Q3	–Q4	–Q5	–Q6	–Q7	–Q8	–Q9	–Q10	–Q11	–Q12	–Q13	–Q14		–Q15	–Q16	–Q17	–Q18	–Q19	–Q20	–Q21	–Q22



32	33	34	35	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
12	13	14	15	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15				0	1	2	3	4	5	6	7

POSICIÓN 2 — TSX DEZ 32D2 — ENTRADAS

POSICIÓN 3 — TSX DEZ 32D2

POSICIÓN 4

SALIDAS
TSX DSZ 32R5
POSICIÓN 10

	11	12	13	14	15
	31	32	33	34	35

RESERVA

Degrémont
TRATAMIENTO DE AGUAS

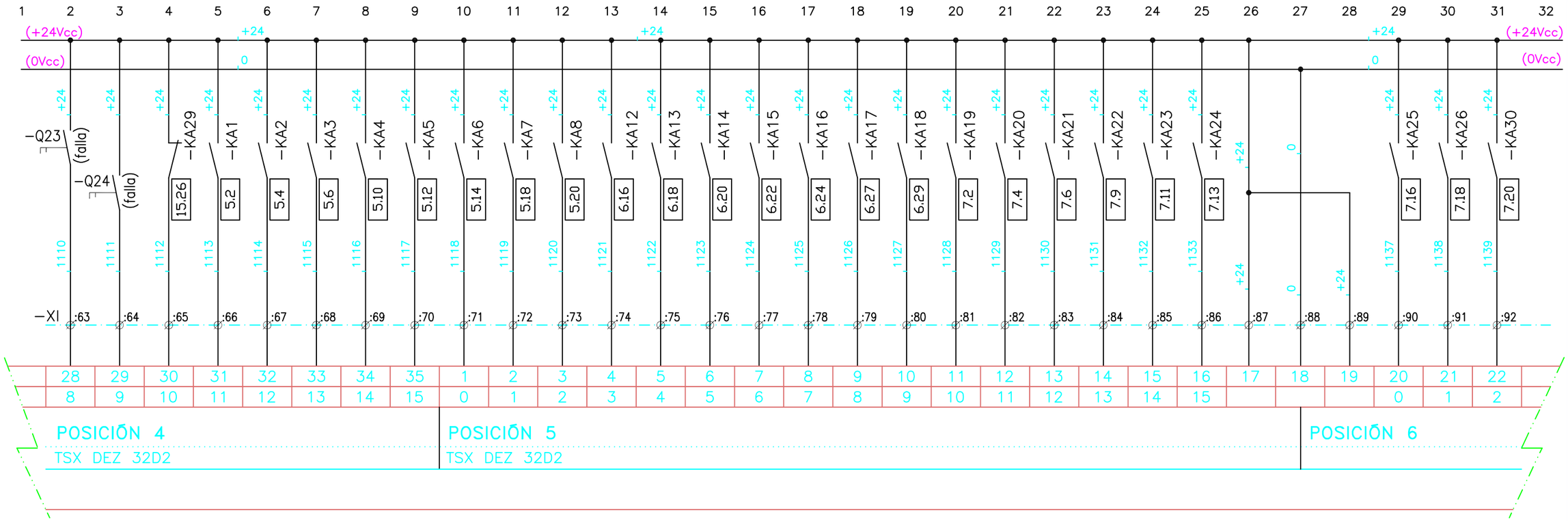
PLANO N° :				
5487	–	802	E	Fecha : 14 / 08 /2001
EJECUCION		NUMERO	REV.	Realizo : CASTAÑO
				HOJA 10 DE 22 HOJAS

DISK N°: 01 ARCHIVO: 5487–802–E hoja 2.dwg

DOCUMENTO CREADO POR ORDENADOR
FORMATO : 420 mm x 297 mm

QUEDA PROHIBIDA LA REPRODUCCION TOTAL O PARCIAL DE ESTE DOCUMENTO SIN PREVIA AUTORIZACION ESCRITA.– PROPIEDAD DE DEGREMONT S.A. –

FALLA ELEC. GUARD.			SEÑALES DE ESTADO DESDE REPETIDORES AUXILIARES																										
8138-J	8140-L	8124-L	LSL 81202	LSL 81203	HS 81202	LSL 81204	LSL 81205	HS 81204	XSH 81206	LSL 81207	LSHH 81201	LSH 81201	LS 81201	LSL 81201	LSLL 81201	XSH 81230	LSL 81231	LSH 81220	LSL 81220	LSLL 81220	LSH 81244	LSL 81244	LSLL 81244		ZSH 8140L	ZSL 8140L	XSH 8140L
-Q23	-Q24	FALLA SV8124																										



(#) CONTACTOS AUXILIARES VARIADOR DE VELOCIDAD

Degrémont
TRATAMIENTO DE AGUAS

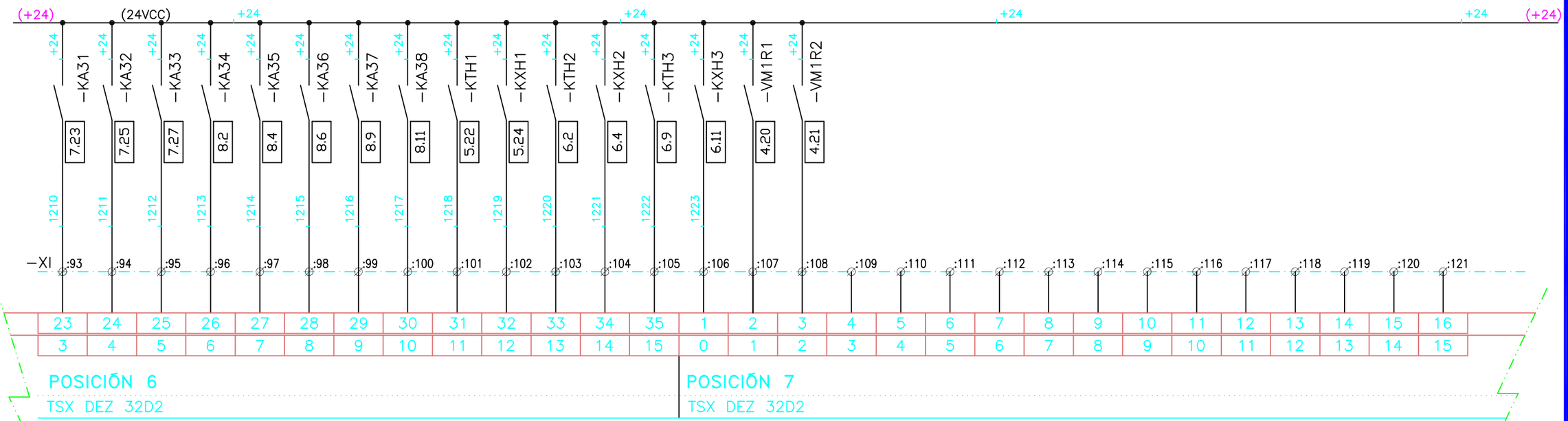
PLANO N° :				
5487	–	802	E	Fecha : 14 / 08 /2001
EJECUCION		NUMERO	REV.	Realizo : CASTAÑO
				HOJA 11 DE 22 HOJAS

QUEDA PROHIBIDA LA REPRODUCCION TOTAL O PARCIAL DE ESTE DOCUMENTO SIN PREVIA AUTORIZACION ESCRITA.- PROPIEDAD DE DEGREMONT S.A. -

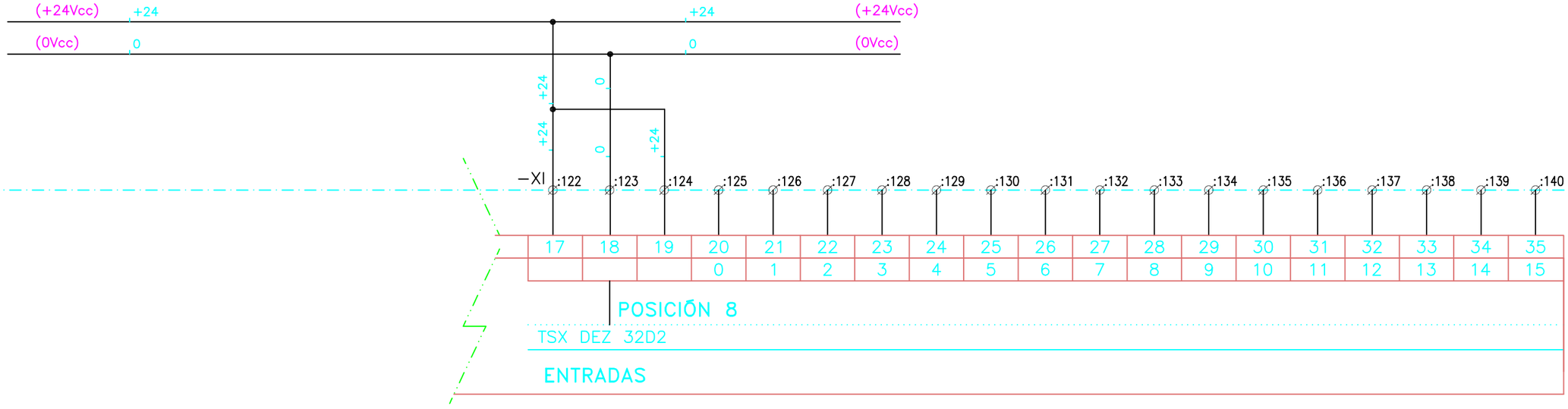
DISK N°: 01 ARCHIVO: 5487-802-E hoja 2.dwg

DOCUMENTO CREADO POR ORDENADOR
FORMATO : 420 mm x 297 mm

SEÑALES DE ESTADO DESDE REPETIDORES AUXILIARES																RESERVAS
LSH 81212	LSL 81212	LSLL 81212	LSH 81236	LSL 81236	LSLL 81236	PSL 81209	PSL 81233	8121–J ALTA TEMP.	8121–J HUMEDAD	8122–J ALTA TEMP.	8122–J HUMEDAD	8123–J ALTA TEMP.	8123–J HUMEDAD	LSH 8135	LSL 8135	
1 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18 19 20 21 22 23 24 25 26 27 28 29 30 31 32



RESERVAS



Degrémont
TRATAMIENTO DE AGUAS

PLANO N° :				
5487	–	802	F	Fecha : 20 / 05 /2014
EJECUCION		NUMERO	REV.	Realizo : F.S.
				HOJA 12 DE 22 HOJAS

DISK N°: 01 ARCHIVO: 5487–802–E hoja 2.dwg

DOCUMENTO CREADO POR ORDENADOR
FORMATO : 420 mm x 297 mm

QUEDA PROHIBIDA LA REPRODUCCION TOTAL O PARCIAL DE ESTE DOCUMENTO SIN PREVIA AUTORIZACION ESCRITA.– PROPIEDAD DE DEGREMONT S.A. –

8126–L	8126–LA	SELECCION DE CUBA	8128–J		8128–JA		8127–L
AGITADOR COAGULANTE	AGITADOR COAGULANTE	NIVELES DE CUBA	BOMBA DOSIFICADORA COAGULANTE		BOMBA DOSIFICADORA COAGULANTE		AGITADOR FLOCULANTE
MANUAL–CAMPO	MANUAL–CAMPO		MANUAL–CAMPO	AUTOM. AL PLC	MANUAL–CAMPO	AUTOM. AL PLC	MANUAL–CAMPO

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

(P1) (220VCA) (24VCC) (+24)

410 +24

–FE1 2A · –FE2 2A · –FE3 2A · –FE4 2A · –FE5 2A

–S1 · –S2 · –S3 · –S4 · –S5 (0 1 / M 0 A)

1310 1311 1315 1316 1325 1326 1330 1335 1336 1340 1345 1346

–X1 :13 :16 :19 :22 :1

–K1 2 · –K2 7 · –K3 17 · –K4 22 · –K5 28

+JS1 +JS2 +JS3 +JS4 +JS5 :1 :2 :3

–SA –SP

1312 1317 1322 1347 910 911

–X1 :14 :17 :20 :23 :2

9.2 9.3 (–XS:1) (–XS:2)

–KA3 5.6 · –KA1 5.2 · –KA2 5.2

1320 1321 1322

–X1 :15 :18 :21 :24 :3

1313 1318 1327 1337 1348

–KA27 12

1328 1338

–K1 · –K2 · –K3 · –K4 · –K5

1314 1319 1329 1339 1349

–Q1 (aux.) · –Q2 (aux.) · –Q3 (aux.) · –Q4 (aux.) · –Q5 (aux.)

(P2) 411

	NA	NC
–Q1 (aux.)	2 19.5	19.7
–Q2 (aux.)	9 19.9	19.11
–KA27	17 22	
–Q3 (aux.)	19 9.21 19.13	19.15
–Q4 (aux.)	24 9.22 19.17	19.19
–Q5 (aux.)	30 19.21	19.23

Degrémont TRATAMIENTO DE AGUAS

PLANO N° : 5487 – 802 E

EJECUCION NUMERO REV.

Fecha : 14 / 08 /2001

Realizo : CASTAÑO

HOJA 13 DE 22 HOJAS

DISK N°: 01 ARCHIVO: 5487–802–E hoja 2.dwg

DOCUMENTO CREADO POR ORDENADOR
FORMATO : 420 mm x 297 mm

QUEDA PROHIBIDA LA REPRODUCCION TOTAL O PARCIAL DE ESTE DOCUMENTO SIN PREVIA AUTORIZACION ESCRITA.– PROPIEDAD DE DEGREMONT S.A. –

A3

8127–LA	SELECCION DE CUBA	8129–J		8129–JA		8121–J		
AGITADOR FLOCULANTE	NIVELES DE CUBA	BOMBA DOSIFICADORA FLOCULANTE		BOMBA DOSIFICADORA FLOCULANTE		BOMBA ELEVADORA PILETA API		
MANUAL–CAMPO		MANUAL–CAMPO	AUTOM. AL PLC	MANUAL–CAMPO	AUTOM. AL PLC	MANUAL–CAMPO	AUTOM. AL PLC	

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

(P1) (220VCA) (+24) (24VCC)

410 +24 410 +24 410 +24 410 +24 (P1) (+24)

FE6 2A — 410 — 1410 — **S6** (0 1) — 1411 — 1411 — **X1:4** — 1411 — **K6** 2 — 1412 — **+JS6** :1 — **SA** — **X1:5** — :2 — **SP** — :3 — **X1:6** — 1413 — 1413 — **K6** — 1414 — **Q6 (aux.)** — (P2) 411

NA	NC
2	19.27
19.25	

KA6 5.14 — 410 — 1420 — 1420 — **KA4** 5.10 — 1421 — 1421 — **KA28** — 411

NA	NC
12	
17	

FE7 2A — 410 — 1425 — **S7** (M 0 A) — 1426 — 1426 — 1430 — **X1:7** — 9.4 — **K7** 11 — 912 — **+JS7** :1 — **SA** — **X1:8** — :2 — **SP** — :3 — 912 — 9.4 — (–XS:3) — **X1:9** — 1427 — **KA28** 7 — 1428 — **K7** — 1429 — **Q7 (aux.)** 411

NA	NC
14	19.31
9.23	
19.29	

FE8 2A — 410 — 1435 — **S8** (M 0 A) — 1436 — 1436 — 1440 — **X1:10** — 9.5 — **K8** 17 — 913 — **+JS8** :1 — **SA** — **X1:11** — :2 — **SP** — :3 — 913 — 9.5 — (–XS:4) — **X1:12** — 1437 — **KA28** 7 — 1438 — **K8** — 1439 — **Q8 (aux.)** 411

NA	NC
19	20.3
9.24	
20.1	

FE9 2A — 410 — 1445 — **S9** (M 0 A) — 1446 — 1446 — 1455 — **X1:25** — 9.6 — **K9L** 22 — 914 — **+JS9** :1 — **SA** — **X1:26** — :2 — **SP** — :3 — 914 — 9.6 — (–XS:5) — **X1:27** — 1447 — **KA9** 5.26 — 1448 — **KA16** 6.24 — 1449 — **K9L** — 1450 — **Q9 (aux.)** 411

1449 1449 — **Kt9** 28 — 1451 — **K9T** 26 — 1452 — **K9E** — 1450 1450

1449 1449 — **Kt9** 28 — 1453 — **K9E** 24 — 1454 — **K9T** — 1450

1449 — **Kt9** — 1450

(P2)

NA	NC
24	20.7
9.25	
20.5	

NA	NC
	26

NA	NC
	24

NA	NC
26	24

QUEDA PROHIBIDA LA REPRODUCCION TOTAL O PARCIAL DE ESTE DOCUMENTO SIN PREVIA AUTORIZACION ESCRITA.– PROPIEDAD DE DEGREMONT S.A. –

DOCUMENTO CREADO POR ORDENADOR
FORMATO : 420 mm x 297 mm
DISK N°: 01 ARCHIVO: 5487–802–E hoja 2.dwg

Degrémont TRATAMIENTO DE AGUAS

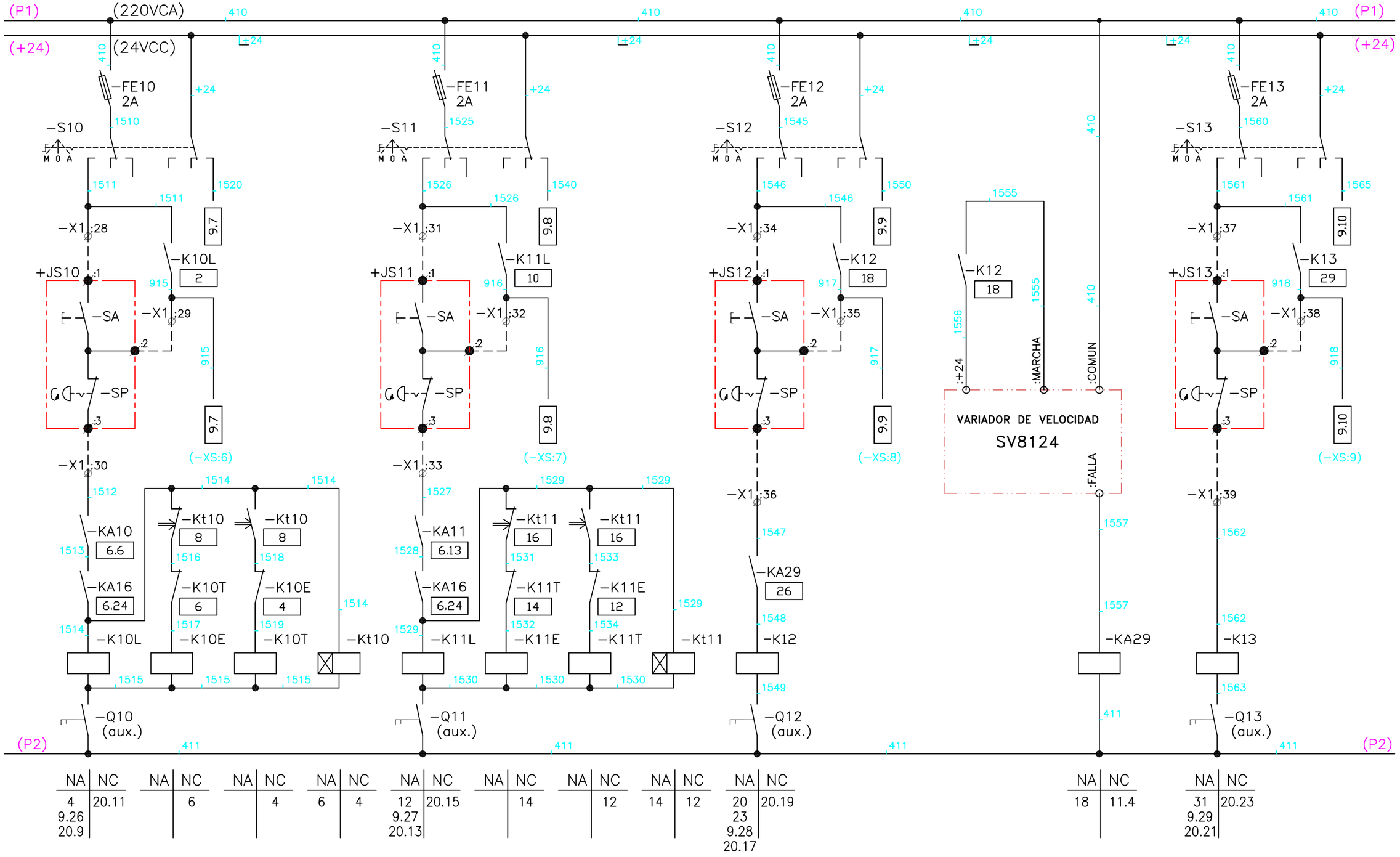
PLANO N° : 5487 – 802 E
EJECUCION NUMERO REV.

Fecha : 14 / 08 /2001
Realizo : CASTAÑO
HOJA 14 DE 22 HOJAS

A3

8122–J	8123–J	8124–L				8125–L	
BOMBA ELEVADORA PILETA API	BOMBA ELEVADORA PILETA API	AGITADOR RAPIDO				FLOCULADOR	
MANUAL–CAMPO / AUTOM. AL PLC	MANUAL–CAMPO / AUTOM. AL PLC	MANUAL–CAMPO	AUTOM. AL PLC	HABILITACION VARIADOR	FALLA VARIADOR	MANUAL–CAMPO	AUTOM. AL PLC

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32



QUEDA PROHIBIDA LA REPRODUCCION TOTAL O PARCIAL DE ESTE DOCUMENTO SIN PREVIA AUTORIZACION ESCRITA.– PROPIEDAD DE DEGREMONT S.A. –

DISK N°: 01 ARCHIVO: 5487–802–E hoja 2.dwg
DOCUMENTO CREADO POR ORDENADOR FORMATO : 420 mm x 297 mm

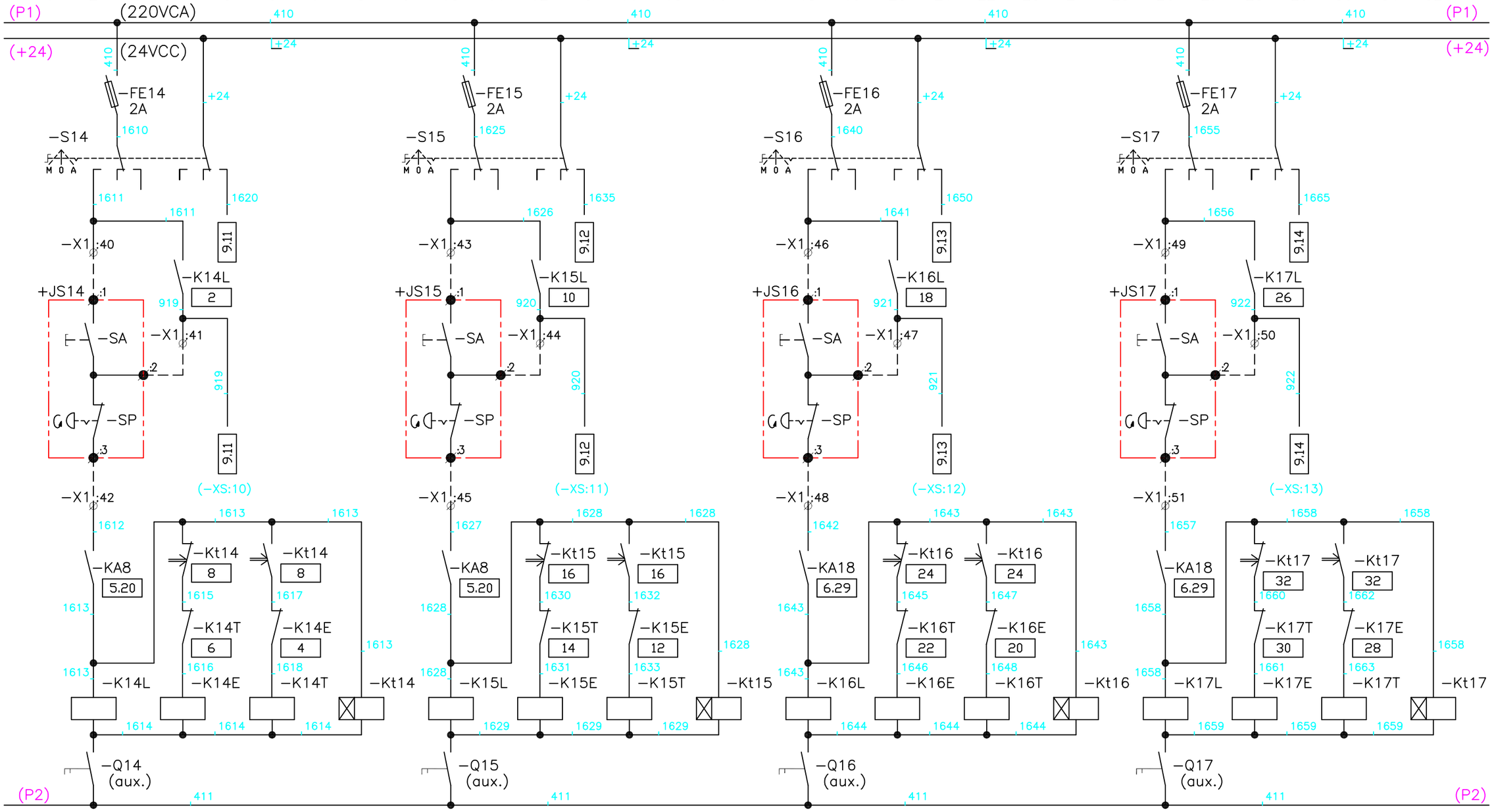
Degrémont TRATAMIENTO DE AGUAS

PLANO N° : 5487 – 802 E
EJECUCION NUMERO REV.

Fecha : 14 / 08 /2001
Realizo : CASTAÑO
HOJA 15 DE 22 HOJAS

A3

8131–J	8131–JA	8136–J	8136–JA
BOMBA DE PRESURIZACION	BOMBA DE PRESURIZACION	BOMBA DE PRESURIZACION	BOMBA DE PRESURIZACION
MANUAL–CAMPO / AUTOM. AL PLC	MANUAL–CAMPO / AUTOM. AL PLC	MANUAL–CAMPO / AUTOM. AL PLC	MANUAL–CAMPO / AUTOM. AL PLC



NA	NC	NA	NC	NA	NC	NA	NC	NA	NC	NA	NC	NA	NC	NA	NC	NA	NC	NA	NC	NA	NC	NA	NC	NA	NC	NA	NC
4 9.30 20.25	20.27		6		4	6	4	12 9.31 20.29	20.31		14		12	14	12	20 10.2 21.1	21.3		22		20	22	20	28 10.3 21.5	21.7		30		28	30	28

QUEDA PROHIBIDA LA REPRODUCCION TOTAL O PARCIAL DE ESTE DOCUMENTO SIN PREVIA AUTORIZACION ESCRITA.– PROPIEDAD DE DEGREMONT S.A. –

DISK N°: 01 ARCHIVO: 5487–802–E hoja 2.dwg

DOCUMENTO CREADO POR ORDENADOR FORMATO : 420 mm x 297 mm

Degrémont TRATAMIENTO DE AGUAS

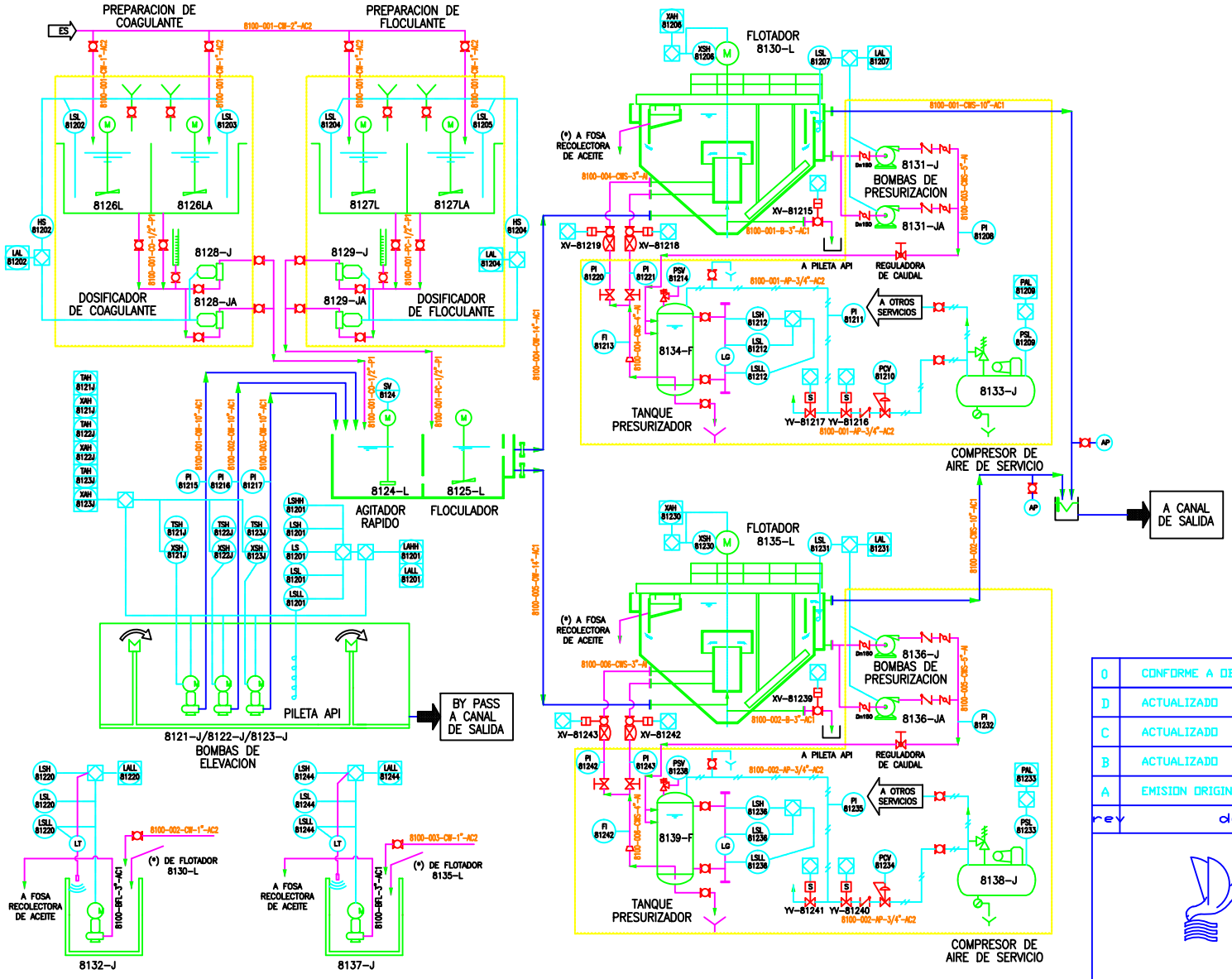
PLANO N° : 5487 – 802 E

EJECUCION NUMERO REV.

Fecha : 14 / 08 /2001

Realizo : CASTAÑO

HOJA 16 DE 22 HOJAS



NOTAS :

IDENTIFICACION DE LINEAS

8100–CWS–4"–AC1
- MATERIAL CARACTERISTICO
- DIAMETRO EN PULGADAS
- IDENTIFICACION DEL FLUIDO
- AREA

SIMBOLOGIA PARA FLUIDOS

- OW–EFLUENTE CRUDO
- CO–COAGULANTE ORGANICO
- PC–FLOCULANTE ORGANICO
- CWS–EFLUENTE TRATADO
- AP–AIRE DE SERVICIO
- BFL–FANGOS FLOTADOS
- B–FANGOS
- CW–AGUA DE SERVICIO

SIMBOLOGIA DE MATERIALES CARACTERISTICOS

- AC1–ACERO AL CARBONO
- AC2–ACERO AL CARBONO GALVANIZADO
- AI–ACERO INOXIDABLE AISI 316
- P1–POLIPROPILENO

INDICA EQUIPOS MONTADOS SOBRE SKIDS

rev	descripcion	FECHA REAL	FECHA APR	FECHA V° B°
0	CONFORME A OBRA	14-01-02 E.M.P.L.	14-01-02 D.R.N.	14-01-02 F.M.
D	ACTUALIZADO	07-05-01 R.C.G.	07-05-01 D.R.N.	07-05-01 F.M.
C	ACTUALIZADO	27-03-01 R.C.G.	27-03-01 D.R.N.	27-03-01 M.R.
B	ACTUALIZADO	14-03-01 S.E.P	14-03-01 D.R.N.	14-03-01 R.W.
A	EMISION ORIGINAL	08-01-01 E.M.P.L.	09-01-01 D.R.N.	09-01-01 R.W.

Agitador de coagulante 8126–L/8126–LA	Bomba de coagulante 8128–J/8128–JA	Agitador de floculante 8127–L/8127–LA	Bomba de floculante 8129–J/8129–JA	Bomba de elevacion 8121–J/8122–J 8123–J	Agitador rapido 8124–L	Floculador 8125–L	Tanque presurizador 8134–F/8139–F	Flotador 8130–L/8135–L	Bomba de presurizacion 8131–J/8131–JA/8136–J/8136–JA	Compresor aire de servicio 8133–J/8138–J	Bomba de flotante 8132–J/8137–J
Cant : 2	Cant : 1	Cant : 2	Cant : 1	Cant : 3	Cant : 1	Cant : 1	Cant : 2	Cant : 2	Cant : 4	Cant : 2	Cant : 2
Pot : 0.55kw	Qmax : 180 l/h	Pot : 0.55kw	Qmax : 180 l/h	Q : 250 m3/h	Pot : 11Kw	Pot : 1.1 Kw	Diam : 700mm	Diam Nominal : 8.5m	Q : 75 m3/h	Pot : 2.2Kw	Q max=20M3/h
V:1m3 p/cuba		V:1m3 p/cuba		Pd : 1.2Kg/cm2	V: 63rpm	V: 1.5–9rpm	Pres de servicio : 6Kg/cm2	Pot. Acc : 0,25 Kw	Pd : 6.5Kg/cm2	V : 280Lts	ΔH =3 mca
		8125–L		Pot : 16Kw	Diam : 1100mm	Diam : 2800mm	Pres de prueba :9Kg/cm2	Mat: Ac. al carbono	Pot : 37 Kw	Pd : 7Kg/cm2	Pot = 1.4 Kw

Degrémont

TRATAMIENTO DE AGUAS

Buenos Aires

CLIENTE: ANCAP – URUGUAY

TRATAMIENTO DE EFLUENTES

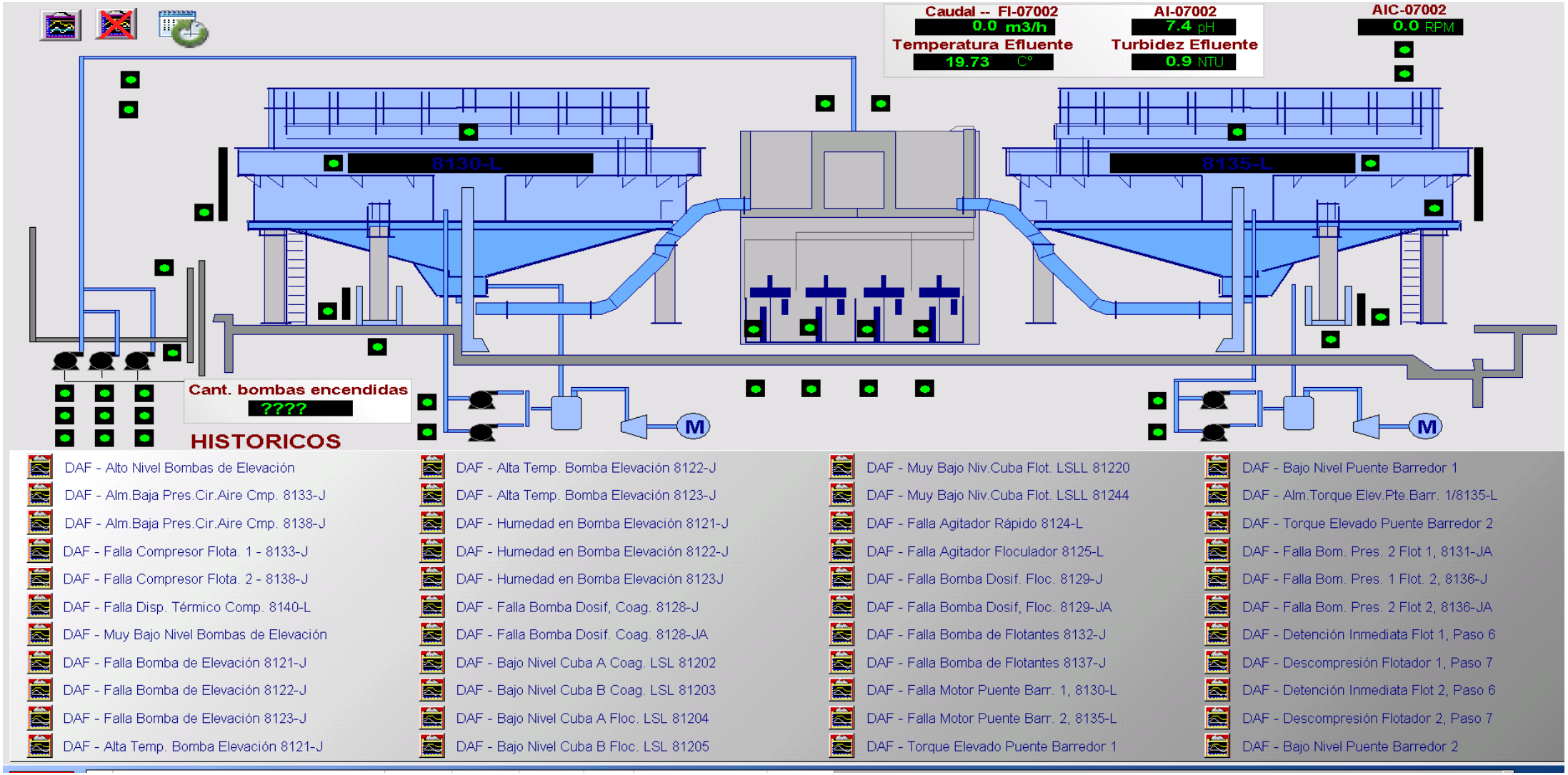
DIAGRAMA DE INGENIERIA

escala

PLANO N°:

5487 (EJECUCION) 001 (NUMERO) / 0 (REV)

A2



- DAF - Alto Nivel Bombas de Elevación
- DAF - Alm.Baja Pres.Cir.Aire Cmp. 8133-J
- DAF - Alm.Baja Pres.Cir.Aire Cmp. 8138-J
- DAF - Falla Compresor Flota. 1 - 8133-J
- DAF - Falla Compresor Flota. 2 - 8138-J
- DAF - Falla Disp. Térmico Comp. 8140-L
- DAF - Muy Bajo Nivel Bombas de Elevación
- DAF - Falla Bomba de Elevación 8121-J
- DAF - Falla Bomba de Elevación 8122-J
- DAF - Falla Bomba de Elevación 8123-J
- DAF - Alta Temp. Bomba Elevación 8121-J
- DAF - Alta Temp. Bomba Elevación 8122-J
- DAF - Alta Temp. Bomba Elevación 8123-J
- DAF - Humedad en Bomba Elevación 8121-J
- DAF - Humedad en Bomba Elevación 8122-J
- DAF - Humedad en Bomba Elevación 8123J
- DAF - Falla Bomba Dosif, Coag. 8128-J
- DAF - Falla Bomba Dosif. Coag. 8128-JA
- DAF - Bajo Nivel Cuba A Coag. LSL 81202
- DAF - Bajo Nivel Cuba B Coag. LSL 81203
- DAF - Bajo Nivel Cuba A Floc. LSL 81204
- DAF - Bajo Nivel Cuba B Floc. LSL 81205
- DAF - Muy Bajo Niv.Cuba Flot. LSLL 81220
- DAF - Muy Bajo Niv.Cuba Flot. LSLL 81244
- DAF - Falla Agitador Rápido 8124-L
- DAF - Falla Agitador Floculador 8125-L
- DAF - Falla Bomba Dosif. Floc. 8129-J
- DAF - Falla Bomba Dosif, Floc. 8129-JA
- DAF - Falla Bomba de Flotantes 8132-J
- DAF - Falla Bomba de Flotantes 8137-J
- DAF - Falla Motor Puente Barr. 1, 8130-L
- DAF - Falla Motor Puente Barr. 2, 8135-L
- DAF - Torque Elevado Puente Barredor 1
- DAF - Bajo Nivel Puente Barredor 1
- DAF - Alm.Torque Elev.Pte.Barr. 1/8135-L
- DAF - Torque Elevado Puente Barredor 2
- DAF - Falla Bom. Pres. 2 Flot 1, 8131-JA
- DAF - Falla Bom. Pres. 1 Flot. 2, 8136-J
- DAF - Falla Bom. Pres. 2 Flot 2, 8136-JA
- DAF - Detención Inmediata Flot 1, Paso 6
- DAF - Descompresión Flotador 1, Paso 7
- DAF - Detención Inmediata Flot 2, Paso 6
- DAF - Descompresión Flotador 2, Paso 7
- DAF - Bajo Nivel Puente Barredor 2