Reference Manual
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Delta Mobrey Hydratect 2462

Steam/Water Detection System

delta-mobrey

Delta Mobrey's Hydratect 2462

SAFETY INSTRUCTIONS

Read this manual before working with the product. For personal and system safety, and for optimum product performance, make sure you thoroughly understand the contents before installing, using, or maintaining this product.

Failure to follow these guidelines could result in death or serious injury.

Avoid contact with the leads and terminals. High voltage that may be present on leads can cause electrical shock.

	Information ...points out useful tips, recommendations and information for efficient and trouble-free operation
	CAUTION! ...indicates a potentially dangerous situation that can result in light injuries or damage to equipment or the environment, if not avoided
	WARNING! ...indicates a potentially dangerous situation that can result in serious injury or death, if not avoided
	WARNING! ...identifies hazards caused by electric power. Should the safety instructions not be observed, there is a risk of serious or fatal injury.
	WARNING! ...indicates a potentially dangerous situation that can result in burns, caused by hot surfaces or liquids, if not avoided.
	WARNING! ...indicates a potentially dangerous situation in the hazardous area that can result in serious injury or death, if not avoided.
	Ex applications ...special instructions for Ex applications

Explosive atmospheres

The Instrument must only be installed and maintained by personnel qualified to work on instruments for hazardous areas.

BEFORE INSTALLATION CHECK THAT THE INSTRUMENT CHARACTERISTICS COMPLY WITH PROCESS AND PLANT REQUIREMENTS.

If the equipment is likely to come into contact with aggressive substances , suitable precautions should be taken that prevent it from being adversely affected, thus ensuring that the type of protection is not compromised

Aggressive substances: e.g. acidic liquids or gases that may attack metals or solvents that may affect non-metallic materials.

Suitable precautions: e.g. regular checks as part of routine inspections or establishing from the material's data sheet that it is resistant to specific chemicals.

Installation shall be carried out in accordance with the applicable code of practice or standard (e.g. IEC 60079-14) and the equipment installed so that it is protected against external influences which could adversely affect the explosion protection.

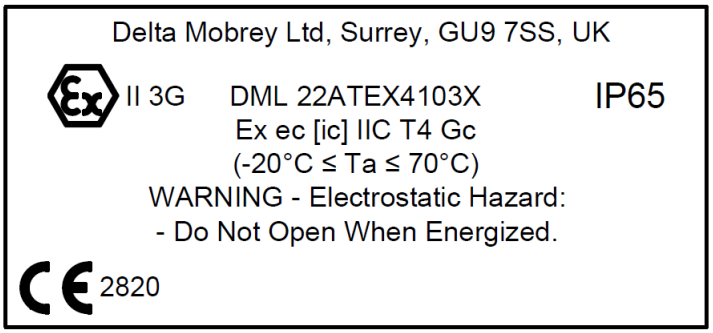
Ambient temperature

The below ambient temperature limits are applicable

Temperature Class	Ambient temperature range
T4 ... T1	From -20 to +70˚C

Marking

the instrument will be supplied with the below marking



Grounding

To minimize the hazard of electrical shock, it is essential that the equipment be connected to a protective ground (earth) whenever the power supply, measurement, or control circuits are connected, even if the equipment is switched off.

The electronics unit must be connected to ground (earth) using the marked case stud before control or signal leads are connected. The ground (earth) connections must have a current rating of 25 A.

Avoid using unsafe equipment

The equipment may be unsafe if any of the following statements apply:

- Equipment shows visible damage.
- Equipment has failed to perform an intended operation.
- Equipment has been stored in unfavorable conditions.
- Equipment has been subjected to severe physical stress.

If in any doubt as to the serviceability of the equipment, do not use it. Get the equipment properly checked by a qualified service technician.

Live electrical wires

When the equipment is connected to a power supply, the opening of covers or removal of parts could expose live electrical wires.

The equipment must be disconnected from all power and signal sources before it is opened for any adjustment, replacement, maintenance, or repair.

Adjustment, maintenance, and repairs must be must be done by qualified personnel. DO NOT OPEN THE ELECTRONICS UNIT WHEN IT IS ENERGIZED.

Equipment modification

To avoid introducing safety hazards, never install non-standard parts in the equipment, or make any unauthorized modification. To maintain safety, always return the equipment to Delta Mobrey Limited for service and repair.

⚠ CAUTION

The equipment described in this reference manual has been designed in accordance with EN61010 "Safety requirements for electrical equipment for measurement, control and laboratory use", and has been supplied in a safe condition.

The equipment is designed solely for electronic measurement and should be used for no other purpose. Delta Mobrey Limited accepts no responsibility for accidents or damage resulting from failure to comply with these precautions.

Cleaning

To clean the instrument, use a damp cloth with a mild, water-based cleaner. Clean the exterior of the instrument only. Do not allow liquids to enter or spill onto the instrument.

Mains ac power supply

Never operate the equipment from a line voltage or frequency in excess of that specified. Otherwise, the insulation of internal components may break down and cause excessive leakage currents.

To allow the electronics unit to be isolated from the ac supply, the supply must be routed through a switch (or circuit breaker). The switch (or circuit breaker) must be within easy reach of the operator and must be clearly identified as the means of supply isolation. The maximum current drawn from the supply must be limited by a fuse or trip, to a maximum of 13 A.

Fuses

Before switching on the equipment, check that the fuses accessible from the interior of the equipment are of the correct rating. The rating of the ac line fuse must be in accordance with the voltage of the ac supply.

Should any fuse continually blow, do not insert a fuse of a higher rating. Switch the equipment off, clearly label it "unserviceable" and inform a service technician.

Not designed for nuclear-qualified applications

The products described in this document are not designed for nuclear-qualified applications. Using non-nuclear qualified products in applications that require nuclear-qualified hardware or products may cause inaccurate readings.

For information on nuclear-qualified products, contact your local Delta Mobrey Sales Representative.

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Section 1 Introduction

1.1 Using this manual

The sections in this manual provide information on installing, operating, and maintaining the Mobrey™ Hydratect 2462. The sections are organized as follows:

Section 2: Installing the electrodes contains the procedures for mounting electrodes to a pipe or manifold.

Section 3: Installing the Electronics Control Unit contains the mechanical and electrical installation procedures.

Section 4: System Testing contains procedures to check the operation of the Hydratect 2462 system after installation completion or any configuration change.

Section 5: Electrodes Servicing describes the electrode servicing procedure that must be followed to ensure continued and trouble-free operation of the Hydratect 2462 system.

Section 6: Electronics Servicing contains fault-finding and fault-correction procedures for the electronics control unit.

Section A: Specifications and Data contains specifications and other reference data, including dimensional drawings.

1.2 Product recycling/disposal

Recycling of equipment and packaging should be taken into consideration and disposed of in accordance with local and national legislation/regulations.

1.3 What the Hydratect 2462 does

The Hydratect 2462 system is the electronic alternative to conventional water level switches on steam-raising plant. The system contains a compact, two-channel electronic control unit connected to a pair of electrodes that are mounted in the plant pipe-work (See Figure 1-1 on page 2).

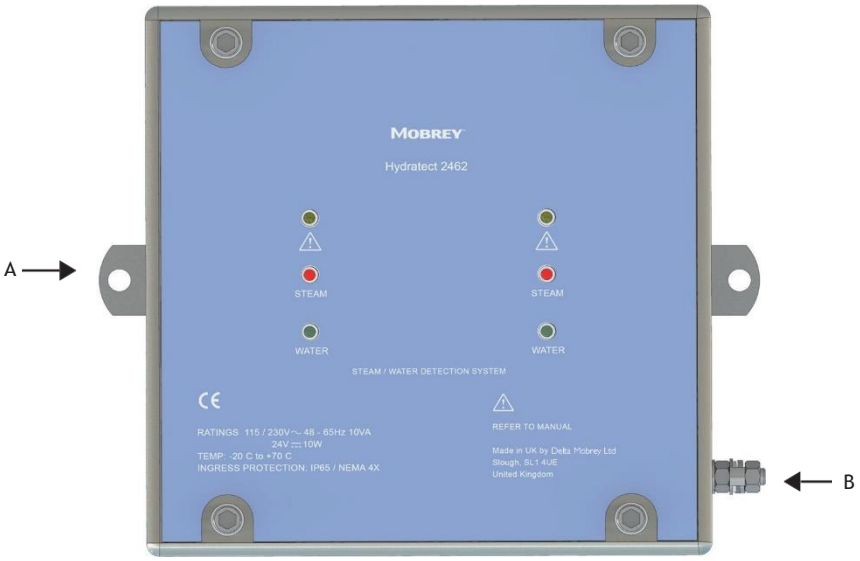
Each of the two channels gives independent indications of the presence of water or steam that are much more reliable than those obtained with conventional electro-mechanical devices. The electronics control unit provides a local indication of steam, water, and fault states, and has configurable fault- and trip-outputs.

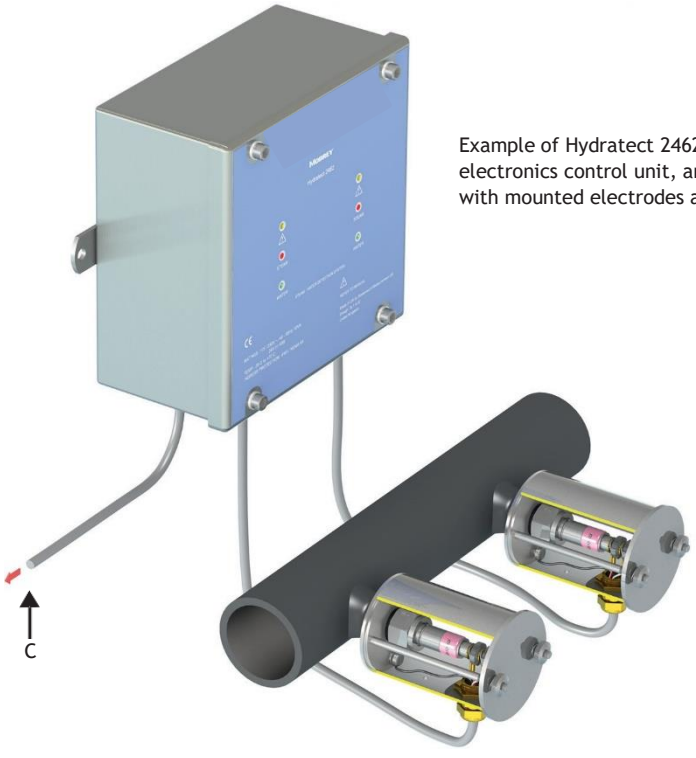
Typical applications of the Hydratect 2462 system are:

- Drain pots.
- Water detection in steam lines.
- Low- or high-level water detection.
- Wherever it is necessary to detect water or steam.

Figure 1-1. The Hydratect 2462 Electronics Control Unit

Front view of electronics control unit





Example of Hydratect 2462 system with the electronics control unit, and horizontal pipe run with mounted electrodes and covers.

A. Wall mounting brackets (lugs).
B. M6 earthing/grounding stud.
C. Alarm and trip signal output.

1.3.1 Steam and water detection

On each of the two electrically-isolated channels, the Hydratect 2462 system detects steam and water by using the differences in their resistance and conductivity (Figure 1-5 on page 7).

Detection of steam and water is indicated by the illumination of a red or green LED on the front panel of the Hydratect 2462 Electronics Control Unit (Figure 1-1 on page 2).
The Hydratect 2462 system also provides status outputs from relays (one per channel) to indicate the detected states. Each status relay has normally-open and normally-closed electrical contacts to control external equipment.

Each Hydratect channel is individually set to a water-normal or steam-normal state by using configuration 'jumpers'[1] on a printed circuit board (PCB). The 'jumpers' must be set to correspond with the normal state of the system. This allows the status relays to default to the not-normal state if the Hydratect 2462 system developed a fault. For example, a status relay is de-energized when a steam-normal channel monitoring a steam line detects water (i.e. a not-normal state). In that situation, the normally-open relay contacts close and the normally-closed contacts open. A latch option is available for each status relay, which, once activated, holds the relay in the not-normal state until reset.

See "Setting the printed circuit board (PCB) jumpers" on page 23 for further information.

1.3.2 Contamination detection

To prevent a build-up of contamination causing a false indication, a contamination detection circuit operates in parallel with the steam/water detection.

An error threshold for the contamination detection circuit can be set for high sensitivity or low sensitivity by using 'jumpers' on a PCB. The circuit can be switched off if not required.
See "Setting the printed circuit board (PCB) jumpers" on page 23 for further information.

Detected contamination on a Hydratect channel is indicated by the front panel fault LED, and a fault relay (one per channel) is de-energized for use by external equipment.

1.3.3 Fail-safe operation

For reliability, each Hydratect channel has a separate power supply.

The Hydratect 2462 system continuously monitors itself for component failure, cable faults, ground (earth) faults, and electrode problems. Components outside the self-monitoring loop are in triplicate such that if two were to fail, the system would still function normally. Component failures are indicated by the front panel fault LED and cause the fault and/or status relays to be de-energized.

Hydratect 2462 system self-checking includes the signal and ground (earth) cable terminations at the electrodes. The fault LED is illuminated and the fault relay is de-energized if one or more conductors become detached.

The ways in which the LEDs and relays indicate the system state are summarized in Table 1-2 and Table 1-3 on page 9.

1. *A PCB 'jumper' is a metal bridge that closes an electrical circuit. Typically, a 'jumper' consists of a plastic plug that fits over a pair of protruding pins. By placing a jumper plug over a different set of pins, you can change a board's parameters.*

Electrode signals, status outputs (relays), and fault outputs (relays) can be validated by connecting both Hydratect channels in a 'one-out-of-two' or 'two-out-of-two' tripping scheme. Typical applications are shown in Figure 1-3 on page 6 and Figure 1-2 on page 5. Further information is in Section 3: Installing the Electronics Control Unit.

1.4 The Hydratect 2462 variants

The Hydratect 2462 Electronics Control Unit is available in three standard configurations, as listed in Table 1-1.

Table 1-1. Hydratect 2462 Variants

Model	Supply		Relay output	
	Mains a.c.	d.c.	SPST relays[1]	DPCO relays[2]
2462A	✓		✓	
2462C		✓	✓	
2462E	✓			✓

1. Single Pole Single Throw (SPST) relays have Normally Open (NO) and Normally Closed (NC) contacts.
2. Double Pole Change Over (DPCO) relays have two sets of Normally Open (NO), Common (C), and Normally Closed (NC) contacts.

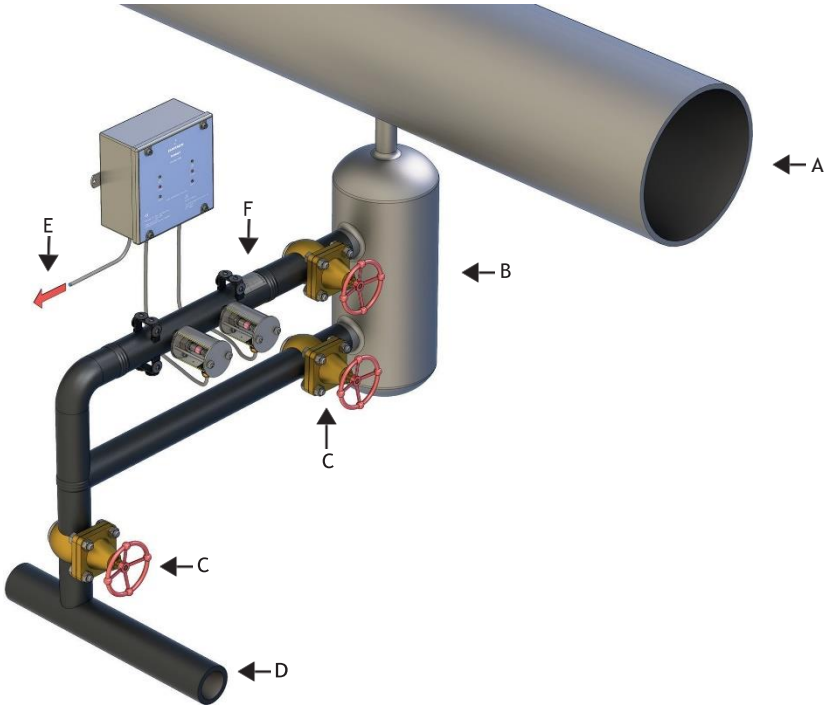
1.5 Typical applications

1.5.1 High water level detection in a drain pot

Figure 1-2 on page 5 shows a system for detecting a high water level in a drain pot attached to a superheat steam line. In this system example, a Mobrey In-line Manifold with two electrodes are used to detect the same level.

The electrode outputs of both Hydratect channels (1 and 2) are connected in a 'one-out-of-two' configuration inside the electronics control unit. Both channels can then indicate a high water level, providing an element of safety if one of the two electrodes fail.

Figure 1-2. High Water Level Detection in Drain Pot



A. Superheat steam line.
B. Drain pot.
C. Isolation valve.
D. Drain line.
E. High alarm signal.
F. In-line manifold with two electrodes (channels 1 and 2).

1.5.2 Water level detection in a boiler drum

A Hydratect 2462 system for detecting high and low water levels in a boiler drum is shown in Figure 1-3 on page 6.

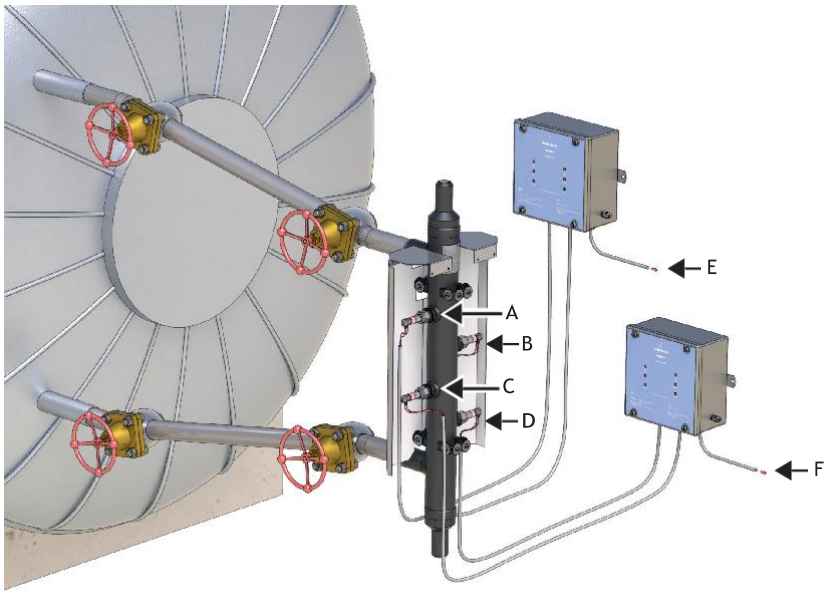
Trip signals are validated by connecting both Hydratect channels using a “two-out-of-two” configuration in a Hydratect 2462 Electronics Control Unit. For example, the high-level trip signal occurs only when water is detected at both the high and the high-high water level electrodes. Further information is in Section 3: Installing the Electronics Control Unit.

The illustrated Hydratect 2462 system uses a sidearm manifold for detecting intermediate water levels between high and low. Connection information for the manifold pipework is in Figure 1-4 on page 6.

Note the following points:

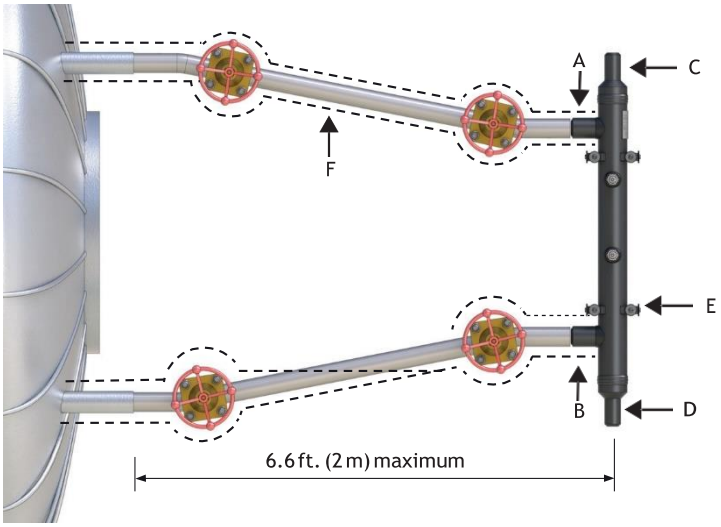
- The connecting pipework must be sloped as indicated in Figure 1-4 on page 6. This is done to ensure a flow of condensate through the manifold.
- The isolating valves, when opened, should allow unrestricted flow through the manifold. Globe valves are highly recommended. These valves should be installed with the handle spindle horizontal.
- The connecting pipework must be insulated, as shown by the dashed lines marked in Figure 1-4 on page 6.

Figure 1-3. Water Level Detection in Boiler Drum



A. High-high level electrode.
B. High level electrode.
C. Low level electrode.
D. Low-low level electrode.
E. High alarm and trip signal output from Control Unit.
F. Low alarm and trip signal output from Control Unit.

Figure 1-4. Manifold Connection Details



A. Steam connection.
B. Water connection.
C. Hanger for suspending the manifold in position.
D. Drain connection.
E. Cover mounting blocks (four positions).
F. Pipe insulation (shown by dashed outline).

Pipe-run slope gradient (1 in 50 minimum). Installation should follow national and station practice.

1.6 How electrodes operate

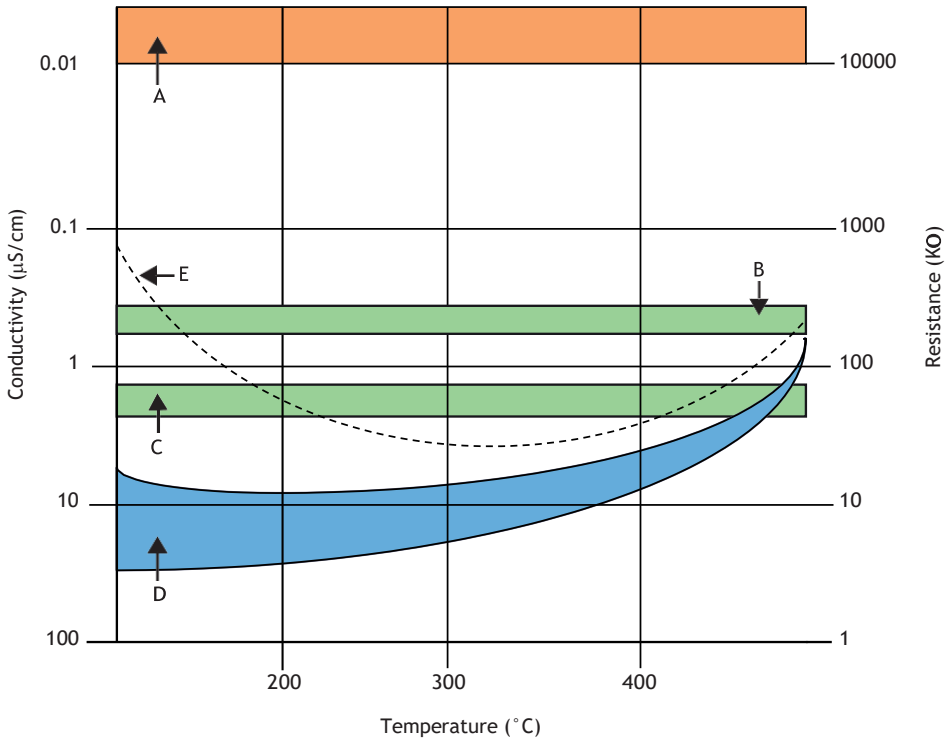
1.6.1 Conductivity and resistance values of steam and water

Figure 1-5 shows conductivity and resistance values of steam, pure water, and typical boiler water. The significant difference between the resistance of steam and boiler water allows the Hydratect 2462 system to differentiate between the two.

An electrode acts as a resistor when inserted into the pipe containing the steam or water. Resistance values are greater than 10 MΩ for steam and between 2 kΩ and 100 kΩ for boiler water. In a Hydratect 2462 Electronics Control Unit, the resistance forms the lower half of a potential divider, across which an alternating driving signal is applied. The signal amplitude of the potential divider output is high for steam (~±6 V) and low for water (~±3 V).

Two conductivity values, 0.6 µS/cm for high sensitivity and 1.6 µS/cm for low sensitivity, are selectable to suit the operating conditions and the purity of the boiler water.
See "Setting the printed circuit board (PCB) jumpers" on page 23 for further information.

Figure 1-5. Conductivity and Resistance of Steam and Water



A. Typical steam values.
B. Hydratect switching band (0.6 µS/cm setting).
C. Hydratect switching band (1.6 µS/cm setting).
D. Typical boiler water
E. Pure water.

1.6.2 The signal returned by the electrode

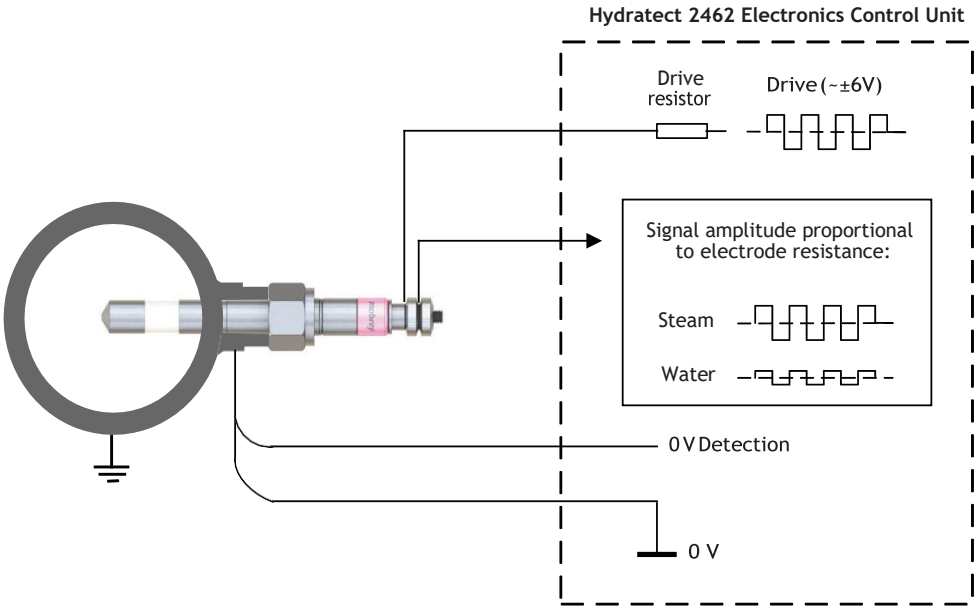
In Figure 1-6, the signal returned by the electrode is proportional to the resistance between the electrode tip and ground (earth). This signal is used to detect the presence of steam or water. A signal with a very small amplitude represents a fault e.g. a broken wire or a short-circuit.

To obtain consistent resistance values, each electrode, and the insert/manifold in which it is mounted, is designed for a common cell constant of 0.1. This gives a resistance of between 2 kΩ and 100 kΩ for typical boiler water, and a resistance greater than 10 MΩ for steam.

Each electrode connection is terminated individually through a crimped nickel terminal ring to enable the Hydratect 2462 Electronics Control Unit to detect an open circuit. Details for the correct connections are given in Section 3: Installing the Electronics Control Unit.

To avoid electrolytic action, the electrode is driven by an alternating signal. The low frequency of this signal ensures that the signal returned by the electrode is unaffected by the cable capacitance.

Figure 1-6. Electrode Returned Signal



1.6.3 LED and relay states for electrodes

Table 1-2 and Table 1-3 on page 9 summarizes the ways in which the LEDs and relays of Hydratect reflect the system state for electrodes.

Note
See "Setting the printed circuit board (PCB) jumpers" on page 23 for information on water-normal and steam-normal settings.

Table 1-2. LED and Relay States for Electrode (Water-Normal Setting)

System state	Front panel LEDs			Relays	
	!	Steam	Water	Fault	Status normal
Electrode in water, no fault	Off	Off	On	Energized	Energized
Electrode in steam, no fault	Off	On	Off	Energized	De-energized
Power supply loss	Off	Off	Off	De-energized	De-energized
Electrode contaminated or short-circuited	On	Off	On	De-energized	Energized
Connection in electrode sense element is broken	On	Off	On	De-energized	Energized
Connection in electrode ground is broken	On	Off	On	De-energized	Energized
Connection to ground sense is broken - electrode in water	On	Off	On	De-energized	Energized
Connection to ground sense is broken - electrode in steam	On	On	Off	De-energized	De-energized

Table 1-3. LED and Relay States for Electrode (Steam-Normal Setting)

System state	Front panel LEDs			Relays	
	!	Steam	Water	Fault	Status normal
Electrode in steam, no fault	Off	On	Off	Energized	Energized
Electrode in water, no fault	Off	Off	On	Energized	De-energized
Power supply loss	Off	Off	Off	De-energized	De-energized
Electrode contaminated or short-circuited	On	Off	On	De-energized	De-energized
Connection in electrode sense element is broken	On	Off	On	De-energized	De-energized
Connection in electrode ground is broken	On	Off	On	De-energized	De-energized
Connection to ground sense is broken - electrode in water	On	Off	On	De-energized	De-energized
Connection to ground sense is broken - electrode in steam	On	On	Off	De-energized	Energized

Section 2 Installing the electrodes

2.1 Electrode installation methods

⚠WARNING

Electrode covers are available which offer a basic level of mechanical and environmental protection, but have not been assessed to any particular protection standards.

Delta Mobrey recommend that the installer gives particular attention to the location and environment where the equipment is being installed and, if necessary, fit additional protective measures.

The electrodes available for use with a Hydratect 2462 system are listed in Table 2-1.

For an electrode to function correctly, it must be contained in a 'cell' of known volume. This allows the Hydratect 2462 Electronics Control Unit to differentiate between the resistance of a known volume of steam and the same volume of water. For this reason, electrodes are mounted in an insert or a manifold.

An insert is for the mounting a single electrode in a vertical or horizontal pipe run, but the manifold is for the mounting of up to four electrodes vertically.

A single Hydratect 2462 system can use one or two electrodes. Where two are used, they should be spaced apart by a minimum of 3 in. (76 mm) if on the same side of the pipe or manifold, or 1.5 in. (38 mm) if on opposite sides.

Table 2-1. Available Electrodes

Part number	Maximum pressure	Maximum temperature	PH range	Insulation type
246785Z	210 bar (3045 psi)	370 °C (698 °F)	7 to 11	Zirconia
246785A	300 bar (4350 psi)	560 °C (1040 °F)	7 to 11	ZTA

2.2 Mounting an electrode to an insert

Mounting an electrode on an insert involves four steps:

1. Welding the insert to the pipe.
   (see “Welding the electrode insert to a pipe” on page 12).
2. Fitting the base plate of an electrode-insert cover
   (see “Fitting the electrode-insert cover (part one)” on page 13).
3. Fitting the electrode to the insert (see “Fitting the electrode” on page 15).
4. Fitting an electrode cover
   (see “Fitting the electrode-insert cover (part two)” on page 16).

Note
See "Mounting electrodes on a manifold" on page 18 for the alternative mounting method.

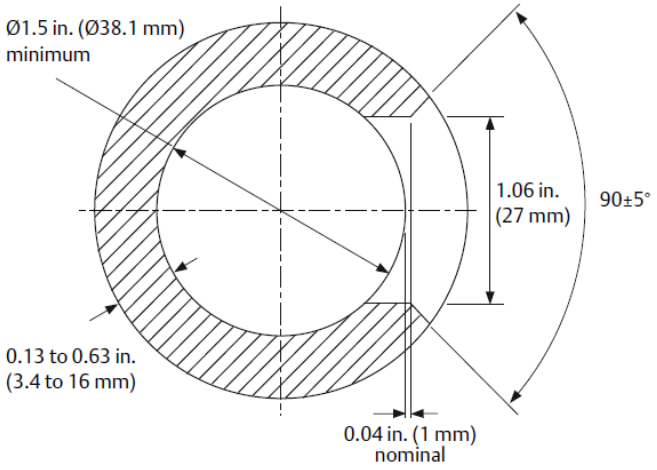
2.2.1 Welding the electrode insert to a pipe

⚠CAUTION

Take care not to damage the thread or conical seat on the Series III electrode insert. The cast/lot number on the insert must not be obscured by welding.

Procedure

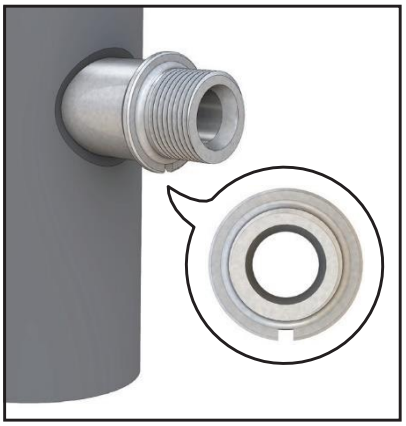
1. Cut an aperture in the pipe for the electrode insert part number 24673540B. (Any debris must be removed from the pipe-work before testing the system).



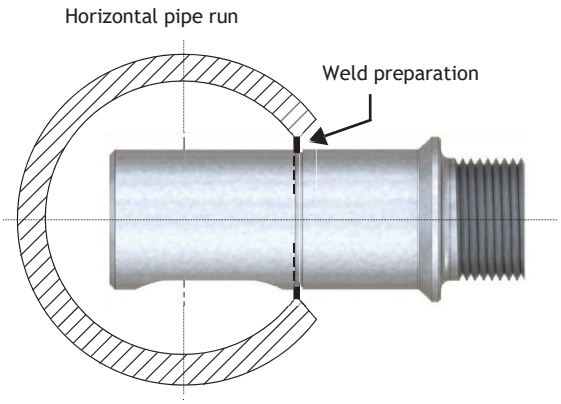
2. Fit the electrode insert into the prepared aperture, ensuring that the orientation slot is pointing downwards.

Horizontal pipe run

Vertical pipe run

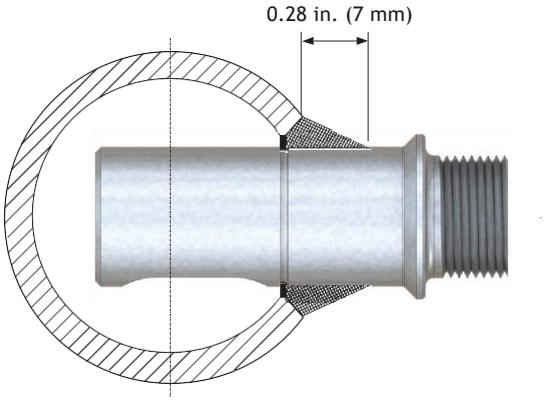


3. Check that the inner edge of the circular groove around the electrode insert body is level with the bottom of the weld preparation.



4. Weld the electrode insert in place.

   The welding procedure must comply with the National or Regional Codes of Practice for Joining Dissimilar Metals.



5. Repeat steps 1 to 4 for the second insert, if required. Electrodes should be spaced apart by a minimum of 3 in. (76 mm).

2.2.2 Fitting the electrode-insert cover (part one)

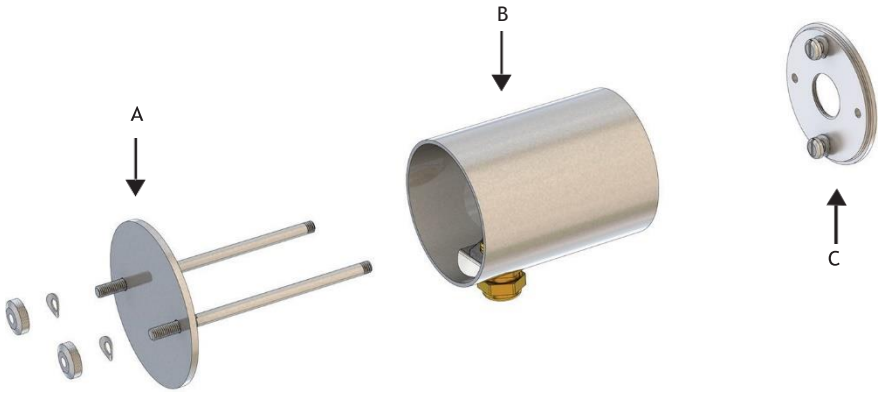
Part one of the cover fitting procedure

1. Dismantle the electrode-insert cover assembly (part number 24670118A) into its component parts (see Figure 2-1 on page 14).

2. Screw the base plate to the electrode insert, and tighten it with a strap wrench (see Figure 2-2 on page 14).

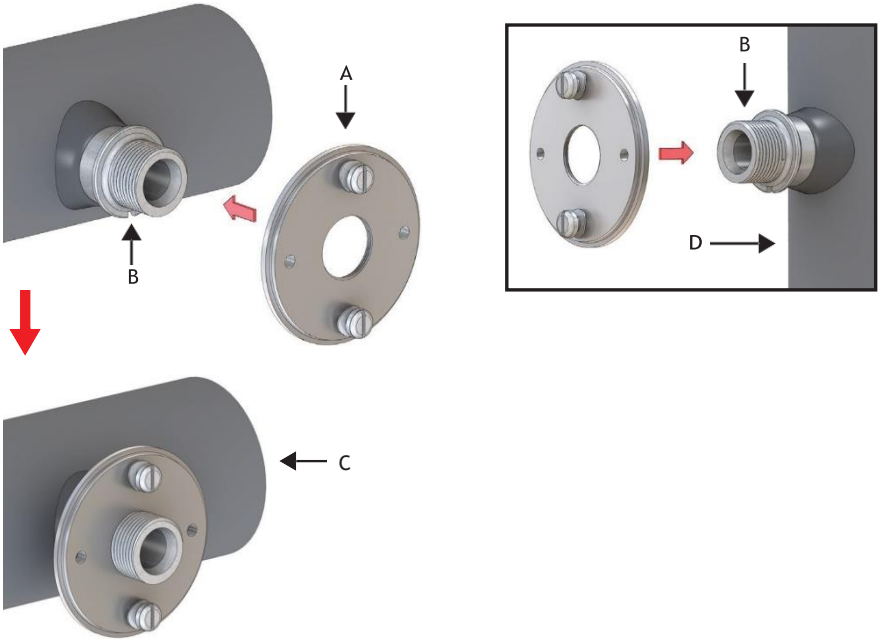
After part one is completed, install the electrode (see “Fitting the electrode” on page 15) and complete cover fitting (see “Fitting the electrode-insert cover (part two)” on page 16).

Figure 2-1. Individual Electrode-insert Cover Assembly of Component Parts



A. Top plate (complete with securing studs, washers, and nuts).
B. Cylindrical housing (complete with cable gland).
C. Base plate (complete with two pairs of earthing/grounding screws and washers).

Figure 2-2. Base Plate Fitting



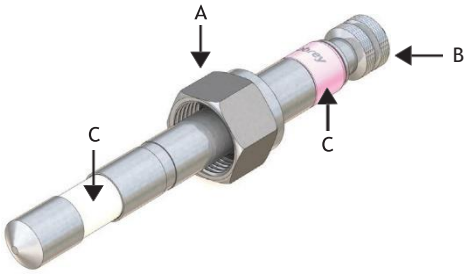
A. Base plate (complete with two pairs of earthing/grounding screws and washers).
B. Electrode insert, with orientation slot pointing downwards, welded to a pipe run.
C. Horizontal pipe run.
D. Vertical pipe run.

The base plate is screwed into the insert on the same thread used for the electrode fixing nut.

2.2.3 Fitting the electrode

To avoid damage, electrodes should be kept in their packaging until they are installed. They are supplied complete with fixing nut, termination nuts, and washers (Figure 2-3).

Figure 2-3. Mobrey Series III Electrode



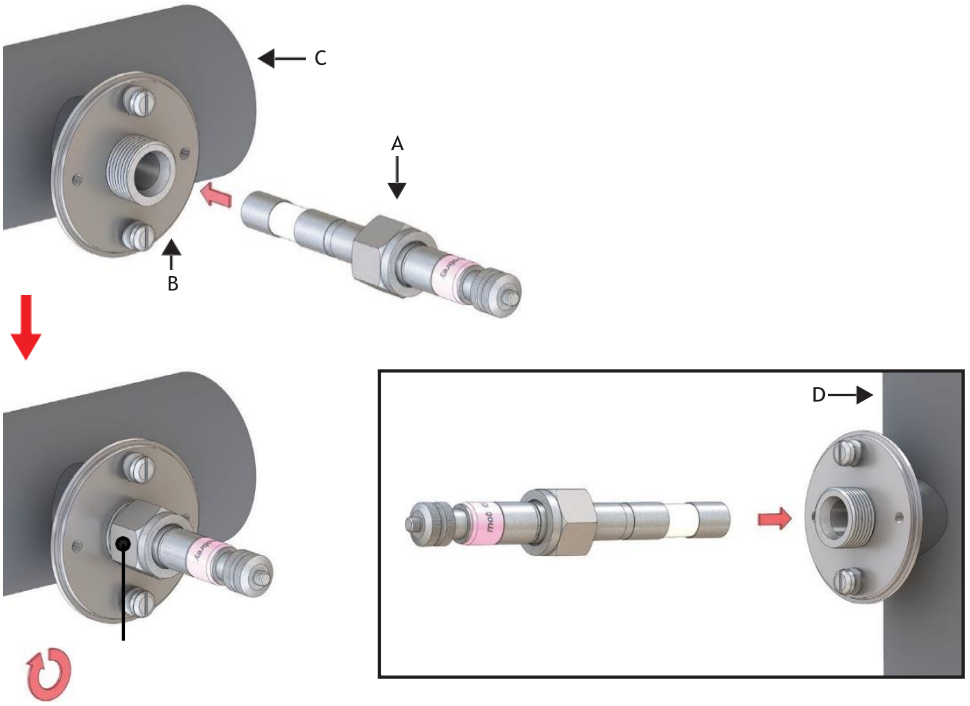
A. Threaded nut for fixing to an insert or manifold port.
B. Termination nuts and washers for electrical connections.
C. Ceramic insulators.

Electrode fitting procedure

1. Carefully unpack the electrode, and then examine for external damage to the ceramic insulators or the electrode seating.
   If the electrode or the electrode insert seat is damaged in any way, contact your local Delta Mobrey sales office.
2. To minimize thread seizure problems, lightly coat the insert thread with anti-seize compound (part number 830007220).
3. Ease the electrode into the insert and then turn the electrode fixing nut, clockwise, with your fingers to engage the threads (Figure 2-4 on page 16).
4. Use a long-reach 25 mm AF socket spanner to gradually tighten the electrode fixing nut until the electrode does not rotate in its' seat.
5. Tighten the electrode fixing nut a further $^{1}/_{8}{}^{th}$ to $^{1}/_{4}$ turn to complete the procedure.

Note
For a high pressure electrode, the final $^{1}/_{8}{}^{th}$ to $^{1}/_{4}$ turn corresponds to a torque level of between 28 lb.ft (35 Nm) and 47 lb.ft (60 Nm). The $^{1}/_{8}{}^{th}$ turn is the recommended tightening condition, $^{1}/_{4}$ is the maximum allowable, and the tightening torque used must be the minimum to achieve this. Failure to comply with this limitation may cause damage to the port or to the electrode from over tightening.

Figure 2-4. Electrode Fitting



A. Mobrey Series III Electrode.
B. Installed base plate of insert cover.
C. Horizontal pipe run.
D. Vertical pipe run.

See "Fitting the electrode" on page 15 for the recommended tightening procedure.

2.2.4 Fitting the electrode-insert cover (part two)

⚠CAUTION

Even if the electrode cable is soon to be connected, it is advisable to complete the installation of the cover rather than leave the electrode exposed to possible damage.

The cover should be removed just prior to fitting the cable and then re-fitted immediately afterwards.

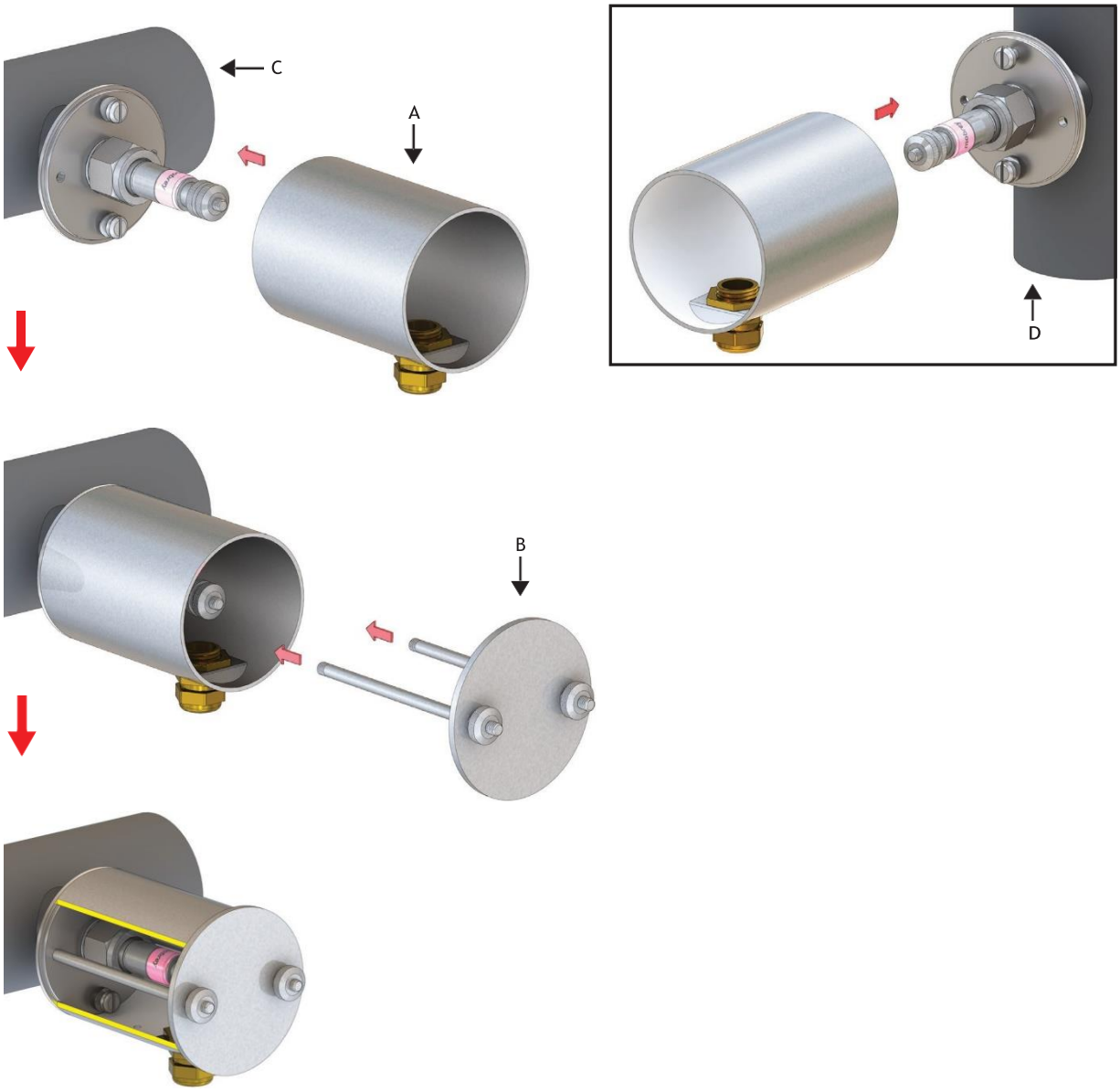
This is the final part of the electrode installation procedure.

Part two of the cover fitting procedure

1. Fit the cylindrical housing, positioning the cable gland downwards for horizontal pipes and as close as possible to downwards for vertical pipes. (see Figure 2-5 on page 17).

2. Fit the top plate and two stud bolts and secure the plate with the two knurled nuts and washers (see Figure 2-5 on page 17).

Figure 2-5. Electrode-insert Cover Fitting (Part Two)



A. Cylindrical housing with cable gland positioned downwards.
B. Top plate with stud bolts, fixing nuts, and washers.
C. Horizontal pipe run
D. Vertical pipe run.

2.3 Mounting electrodes on a manifold

Note
See "Mounting an electrode to an insert" on page 11 for the alternative mounting method.

Procedure

1. Remove the electrode covers and port dust caps.
2. Temporarily cover the manifold ports with heat-resistant material, to prevent the ingress of weld splatter and dirt.
3. Weld the manifold in place, using the procedure recommended by the National or Regional Codes of Practice.
4. Install electrodes in the manifold ports.
   (The fitting procedure is described in "Fitting the electrode" on page 15).
5. Replace the electrode covers and secure them.

⚠CAUTION

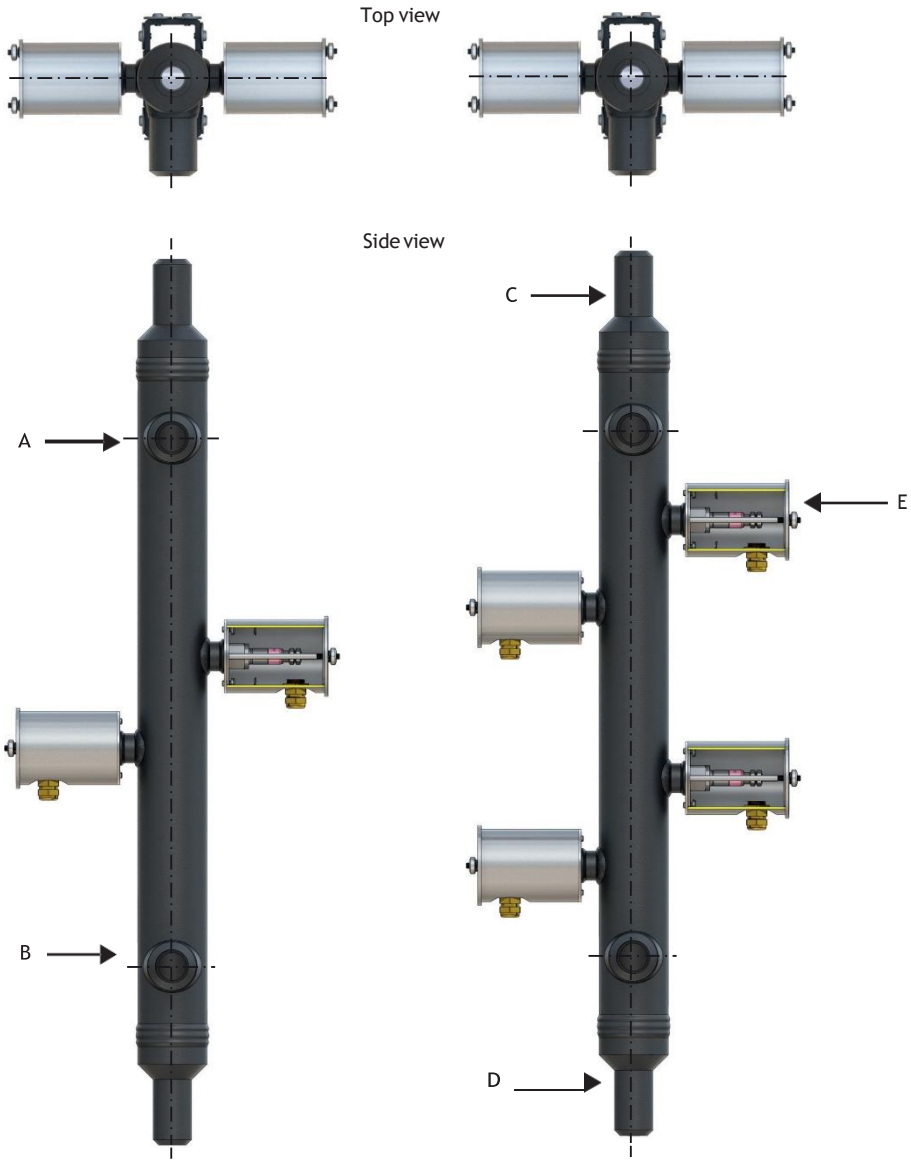
Even if the electrode cable is soon to be connected, it is advisable to complete the installation of the cover rather than leave the electrode exposed to possible damage.

The cover should be removed just prior to fitting the cable and then re-fitted immediately afterwards.

2.4 Customized manifolds

Figure 2-6 on page 19 show details of two- and four-port customized manifolds. These manifolds can be made-to-order to customer requirements. They are side-coupled to the connecting pipework and vertically mounted. Separate vent and drain connections are provided.

Figure 2-6. Mobrey Customized Sidearm Manifolds



A. Steam connection.
B. Water connection.
C. Vent connection or capped.
D. Drain connection.
F. Individual-electrode cover (cutaway to show electrode).

Allow at least 210 mm (8.3 in.) for electrode removal.

Section 3 Installing the Electronics Control Unit

3.1 Installation summary

The basic steps to installing the Hydratect 2462 Electronics Control Unit ("Control Unit") are as follows:

1. Fit cable glands to the bottom of the Control Unit.

   For this, holes need to be cut through 1.6 mm of stainless steel. The required hole sizes depend on the gland type to be fitted.

   See "Fitting cable glands" on page 22 for further information.

2. Mount the Control Unit, taking into consideration:
   a. The Control Unit is to be bolted in position through two brackets (lugs) (see Figure 4 on page 23). Fixing bolts are not supplied with the Control Unit.
   b. The preferred site for the Control Unit is a wall or vertical bracket structure where easy access is available for viewing and servicing, and of suitable composition and load bearing ability to four times the control unit weight.
   c. The case must be bonded to ground (earth) through a suitably-rated cable and grounding (earthing) point.
   d. Control Unit mounting and grounding (earthing) procedures are in the section "Mounting the Hydratect 2462 Control Unit" on page 23.

3. Select the various Hydratect 2462 system configuration options using the 'jumpers' (plug-links) on the internal printed circuit board ("PCB").

   See "Setting the printed circuit board (PCB) jumpers" on page 23 for information.

4. Prepare and connect cables to the front panel.

   These cables are for the electrodes, fault and status relays, and power supplies. When the status relay latch option is fitted, a connection is also required for the latch reset input.

   Cable connections are described in "Connecting the electronics" on page 26.

When the electrodes and the electronics control unit have been installed, the Hydratect 2462 system can be tested. The test procedure is in Section 4: System Testing.

Note
When re-securing the front panel of the electronics control unit with the four screws, ensure the four washers make complete contact with the metalwork of the front panel. The label (art work) on the front panel must not be trapped under these washers.

3.2 Fitting cable glands

Cables must enter through suitably-rated cable glands to ensure the Hydratect 2462 Electronics Control Unit ("Control Unit") interior remains sealed from moisture ingress.

The type of glands used will vary according to locale and application. It is essential to use screened cables and RF glands that give a good annular (ring-shaped) connection to the cable screen (shield) to ensure EMC compliance in European installations.

The IP-rating of the finished enclosure is another consideration. For this reason, it has been left to the installation engineer to arrange for suitable holes to be cut in the underside of the Control Unit when the type of glands to be used is known.

To avoid the glands or cables fouling the internal connectors, the area for mounting the glands has been restricted to that shown in Figure 3-1. The only constraint within this area is that the distance between the peripheries of adjacent holes must not be less than 9 mm. When only one channel is required, the holes for this should be located towards the rear of the Control Unit; this leaves the maximum amount of room between cables and the PCB.

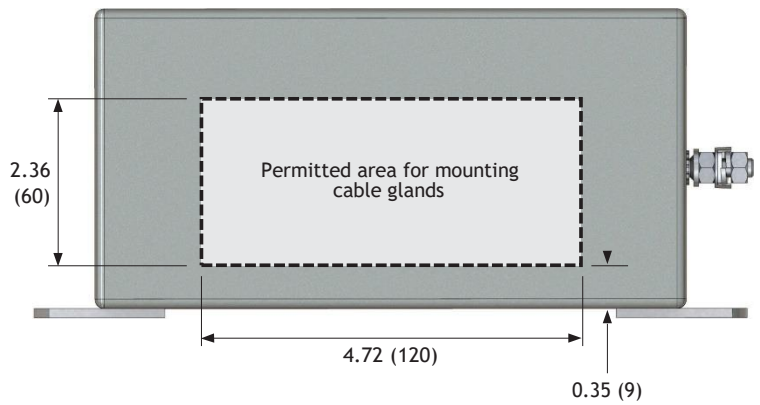
Fitting cable glands procedure

1. Undo the four screws that secure the front panel to the case of the Control Unit.
2. Carefully remove the front panel and keep it in a safe place.

   (The front panel has all the electronic circuitry mounted on it, and must be protected against adverse conditions such as heat, dust, and static electricity).
3. Cut holes of a suitable diameter in the underside of the Control Unit, within the permitted area shown in Figure 3-1.

The case should now be mounted in the intended location, as described in "Mounting the Hydratect 2462 Control Unit" on page 23.

Figure 3-1. Cable Gland Mounting Area Under Control Unit



Dimensions are in inches (mm).

3.3 Mounting the Hydratect 2462 Control Unit

To protect the printed circuit boards (PCBs), the Hydratect 2462 Electronics Control Unit ("Control Unit") must be mounted without the front panel fitted.

Mounting procedure

Note
The Control Unit weight is 2.8 kg (6.2 lb). To conform to safety requirements, the wall or vertical bracket structure on which the Control Unit is mounted must be of a suitable composition and load bearing ability to support four times this weight.

1. Select a suitable location for the Control Unit, taking into consideration:
   a. Cable length restrictions.
   b. Relative positions of the electrodes.
   c. Accessibility for viewing and servicing.
   d. Composition and load bearing ability of the wall to support four times the weight of the control unit.
2. Prepare the fixing points (for screws, bolts, etc.) using the dimensions of the fixing brackets shown in Figure A-1 on page 58.
3. Mount the Control Unit to the wall by screwing or bolting through the brackets.
4. Connect the ground (earth) stud to a suitable grounding (earthing) point. This connection must have a rating of 25 A.

3.4 Setting the printed circuit board (PCB) jumpers

Various configuration options on the front panel PCB can be selected by using 'jumpers'[1] that plug into a DIL pin strip headers labeled PL203 and PL403.

The configuration options are:

- Normal condition for steam/water detection (normal-steam or normal-water).
- Threshold for steam/water detection (high or low sensitivity).
- Electrode contamination detection (disabled or enabled).
- Electrode contamination detection (high or low sensitivity).
- Operation of status relay (latched or non-latching).

Figure 3-2 shows all options and their jumper settings on the DIL pin strip header.

When the Control Unit is shipped from the factory, PCB jumpers are set to a default configuration as shown in Figure 3-3 on page 24.

The locations of PCB jumpers for each of the channels are shown in Figure 3-4 on page 25.

1. *A Jumper is a metal bridge that closes an electrical circuit. Typically, a jumper consists of a plastic plug that fits over a pair of protruding pins. By placing a jumper plug over a different set of pins, you can change a board's parameters.*

Figure 3-2. PCB Jumper Settings for Configuration Options (PL203 and PL403)

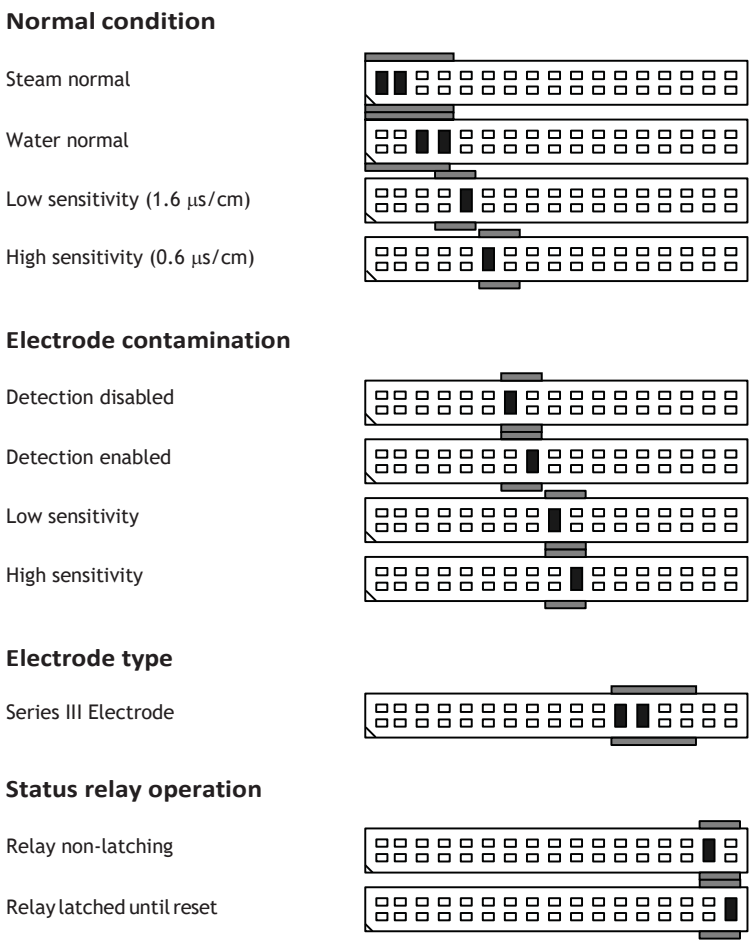


Figure 3-3. Default PCB Jumper Settings (PL203 and PL403)

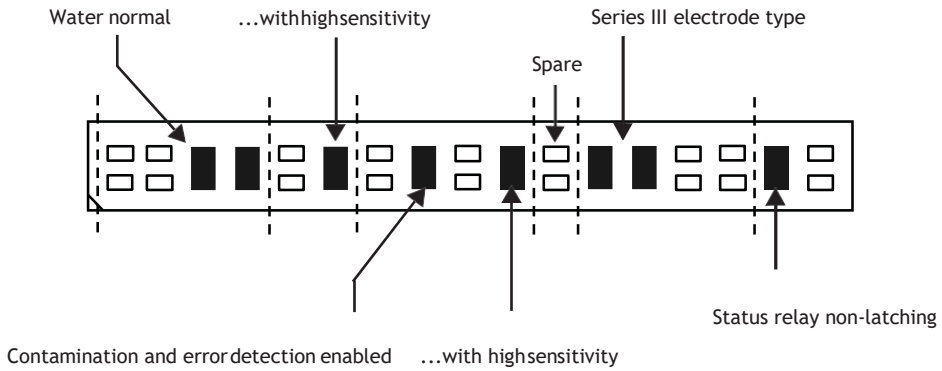
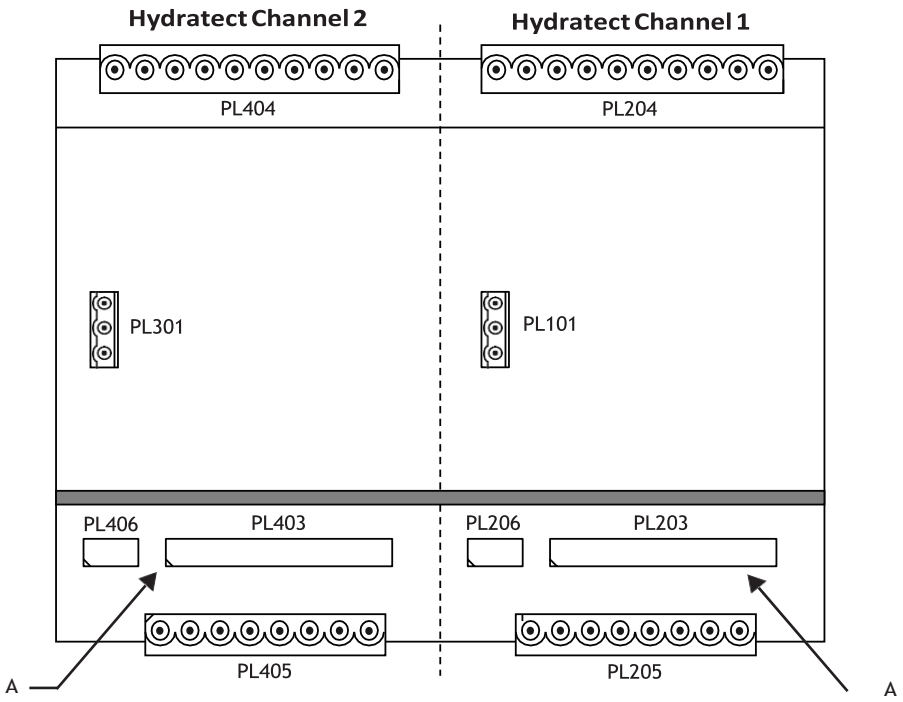


Figure 3-4. PCB Connectors and Jumper Locations



A. PCB jumpers for setting configuration options. (See Figure 3-2 and Figure 3-3 on page 24 for jumper details).

3.5 Connecting the electronics

Connections to the Hydratect 2462 Electronics Control Unit (“Control Unit”) are:

a. Electrode connections.
b. Fault and status relay connections.
c. Power connections.
d. Latched relay reset connections (optional).

3.5.1 Preparing the electrode cable

The procedure for preparing an electrode cable is in two parts:

- Part 1: “Connecting the cable to an electrode” on page 26.
- Part 2: “Preparing electrode cables for connection to the control unit” on page 28.

Table 3-1 lists the four-core electrode cables available from Delta Mobrey. The Hydratect 2462 systems uses all four leads (conductors) of these cables.

Note
The use of cables that are not listed in Table 3-1 may affect system performance.
For security reasons, use continuous cable-runs instead of junction boxes.

Table 3-1. Electrode Cable Availability

Part number	Cable length
24620204A	3 m
24620205A	10 m
24620206A	18 m
24620207A	30 m

Connecting the cable to an electrode

1. Remove the electrode cable from its packaging, being careful not to lose the bag of crimp terminations for the electronics unit end of the cable.

2. Remove the top-plate securing-nuts from the electrode cover (Figure 3-5 on page 27) and then remove the top plate from the housing cylinder.

3. Feed the cable through the cable gland from inside the housing cylinder. Leave about 200 mm of cable (with the crimped terminal rings) protruding from the end of the housing cylinder.

4. On the electrode cover base plate, connect the black and blue conductors, separately, to the two ground/earth screws (Figure 3-6 on page 27).

5. Draw sufficient cable through the cable gland to allow the housing cylinder to be re-seated on the base plate.

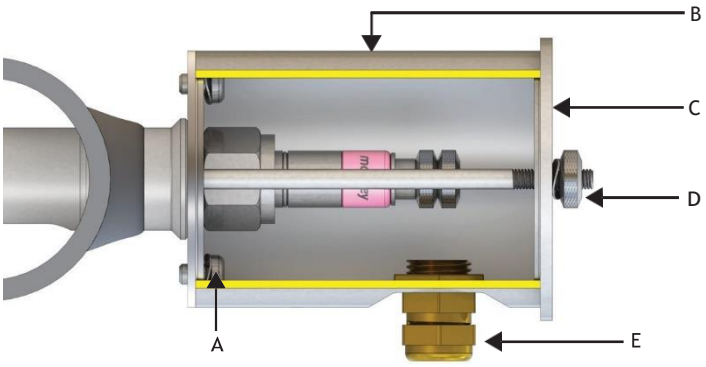
6. On the electrode, secure the red and white conductors under the crinkle-washers and knurled nuts (Figure 3-6).

   Ensure that there is a stress-free run of cable inside the electrode cover and the cable gland is oriented correctly. If necessary, cut back to the cable cover, including the screening foil and screen wire, to achieve thus. The cable screen must not be connected to ground (earth) at the electrode end of the cable.

7. Replace the top plate of the electrode cover and fit the top-plate securing-nuts. Coat the threads with a high temperature, anti-seize compound.

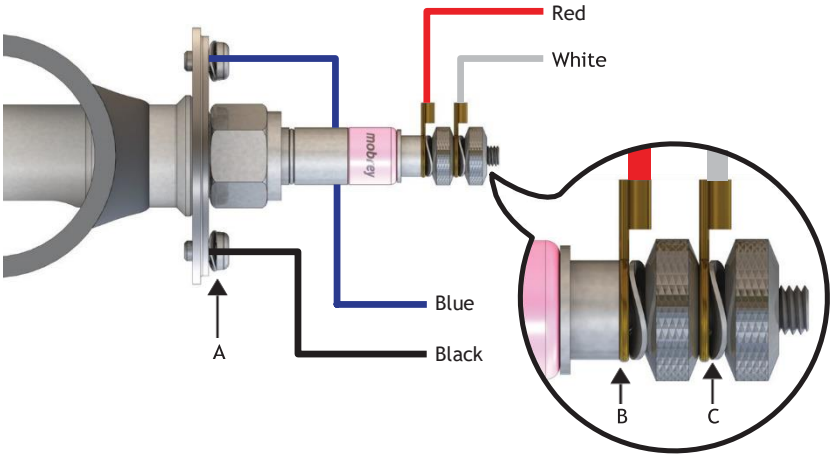
8. Tighten the cable gland.

Figure 3-5. Insert-mounted Electrode Cover Details



A. Ground (earth) screw.
B. Housing cylinder.
C. Top plate.
D. Top-plate securing-nuts.
E. Cable gland.

Figure 3-6. Electrode Cable Connection Details



A. Ground connections are made to two screws in the base plate of the electrode cover.
B. Crimped terminal ring.
C. Crinkle washer.

Preparing electrode cables for connection to the control unit

Note
This following procedure assumes that the electrode cable has already been connected to the electrode as described in "Connecting the cable to an electrode" on page 26.

1. If the front panel of the Hydratect 2462 Electronic Control Unit ("Control Unit") is fitted to the case, remove the panel from the case and store it in a safe place.

   (This is described in more detail on "Fitting cable glands" on page 22. The panel has mounted on it all the electronic circuitry and must be protected against adverse conditions such as heat, dust and static electricity).

2. Route the cable from the electrode to the Control Unit through suitable ducting (conduit).

3. Assemble the cable gland, and fit it to the underside of the Control Unit.
   Allow for cable conductors of length 300 mm inside the unit.

   The electrode cable has an aluminum foil shield (screen), which must be grounded (earthed) to the cable gland on the Control Unit.

   Connection is made through the standard 'drain' wire that runs the full length of the cable and makes good contact with the screen.

   An effective seal against electromagnetic interference is made with good annular (ring-shaped) contact with the RF cable gland. Trim the insulation to leave about 20 mm of metal foil exposed, which can be folded back over the insulation.
   Make sure this foil cover is the part clamped by the screen of the gland when it is tightened. Be careful not to damage the 'drain' wire, which can be clamped as you would do for a braided screen.

4. Slide a ferrite (supplied) over the cables inside the Control Unit and fix it tight against the gland input.

5. Prepare the electrode cable for fitting to an 8-way Klippon connector by stripping the end of each conductor and crimping on the pins required. (Remove only sufficient insulation to ensure good contact: the stripped end must be fully inserted into the pin).

   It is considered good practice to twist the electrode pairs together, and twist all the pairs from one cable into a neat harness within the Control Unit.

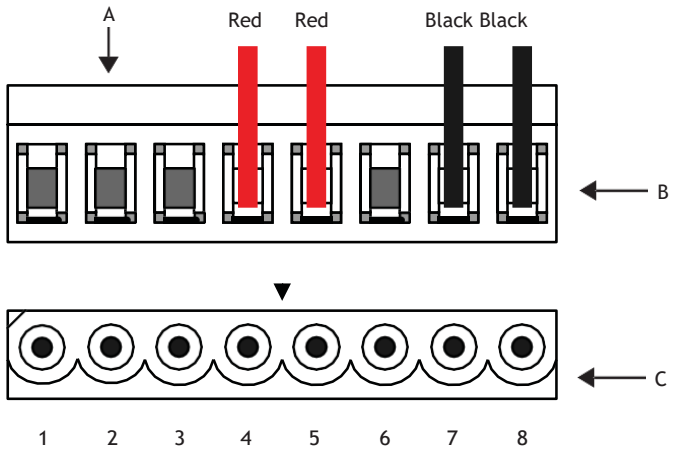
6. Fit the electrode cable to the 8-way Klippon connector by screwing in the crimped-on pins as shown Figure 3-7 or Figure 3-8 on page 29.

   (It is not important which way round paired conductors, e.g. red and white, are connected).

7. Repeat steps 2 to 6 for the second channel.

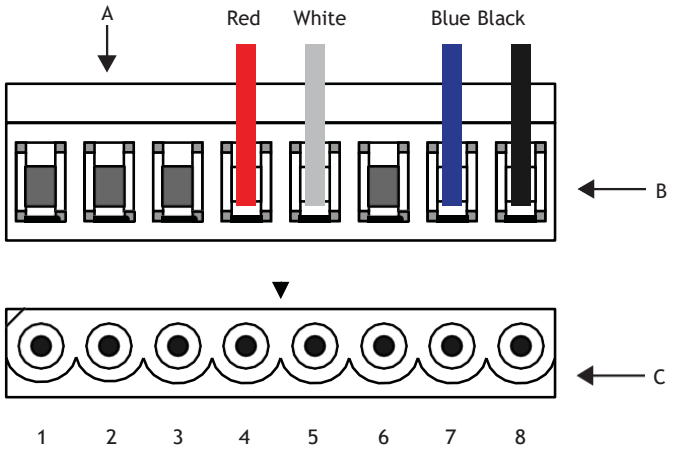
The electrode cables are now ready for connection to the Control Unit front panel. However, it easier to first prepare the fault/status cables and the power cables before connecting the others to the front panel.

Figure 3-7. Fitting 10/18/30 m Electrode Cable to 8-way Connector (PL205 and PL405)



A. Termination screws are on this side.
B. Connector on electrode cable.
C. Connector on Hydratect 2462 front panel printed circuit board: PL205 (Channel 1) and PL405 (Channel 2).

Figure 3-8. Fitting 3m Electrode Cable to 8-way Connector (PL205 and PL405)



A. Termination screws are on this side.
B. Connector on electrode cable.
C. Connector on Hydratect 2462 front panel printed circuit board: PL205 (Channel 1) and PL405 (Channel 2).

3.5.2 Preparing the fault and status relay cable (for the Hydratect 2462A and 2462C)

The Hydratect 2462 Electronics Control Unit ("Control Unit") uses normally-open and normally-closed switched outputs for fault and status indication.

The outputs are available on a pair of 10-way Klippon connectors: PL204 and PL404.

Procedure for making connections to the switched outputs

1. Remove the front panel from the Control Unit case and store it in a safe place.

   (This is described in detail on "Fitting cable glands" on page 22. The panel has mounted on it all the electronic circuitry and must be protected against adverse conditions such as heat, dust, and static electricity).

2. Route the fault/status cable from the external equipment to the Control Unit through suitable ducting (conduit).

3. Assemble the cable gland and fit it to the underside of the Control Unit.

   Screened cables must be used. Ensure there is a good annular (ring-shaped) contact between the cable screen and cable gland. Allow for cable conductors of length 300 mm inside the Control Unit, and twist the power pairs together.

   The fault and status cable should not be shared with electrode or power wires in the same cable.

4. Prepare the fault/status cable for fitting to the Klippon connector, by stripping the end of each conductor and crimping on the pins required.

   (Remove only sufficient insulation to ensure good contact. The stripped-end must be fully inserted into the pin).

5. Fit the cable to a Klippon connector by screwing in the crimped-on pins (Figure 3-9 on page 31).

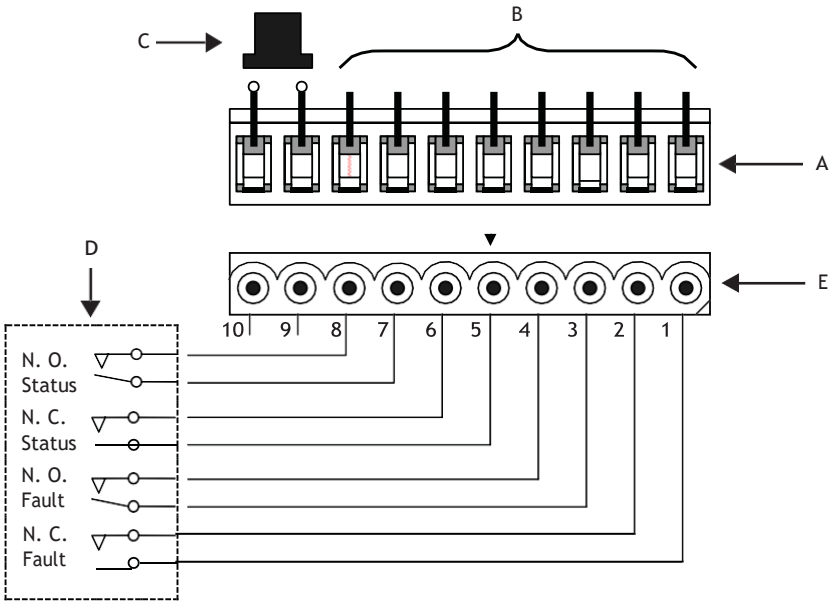
   (Four wiring options are shown in Figure 3-10 though Figure 3-13).

6. Repeat steps 2 to 4 for the second Hydratect channel.

The fault and status cables are now ready for connection to the front panel of the Control Unit. Remember, however, that it is easier to prepare all the cables before connecting them to the front panel.

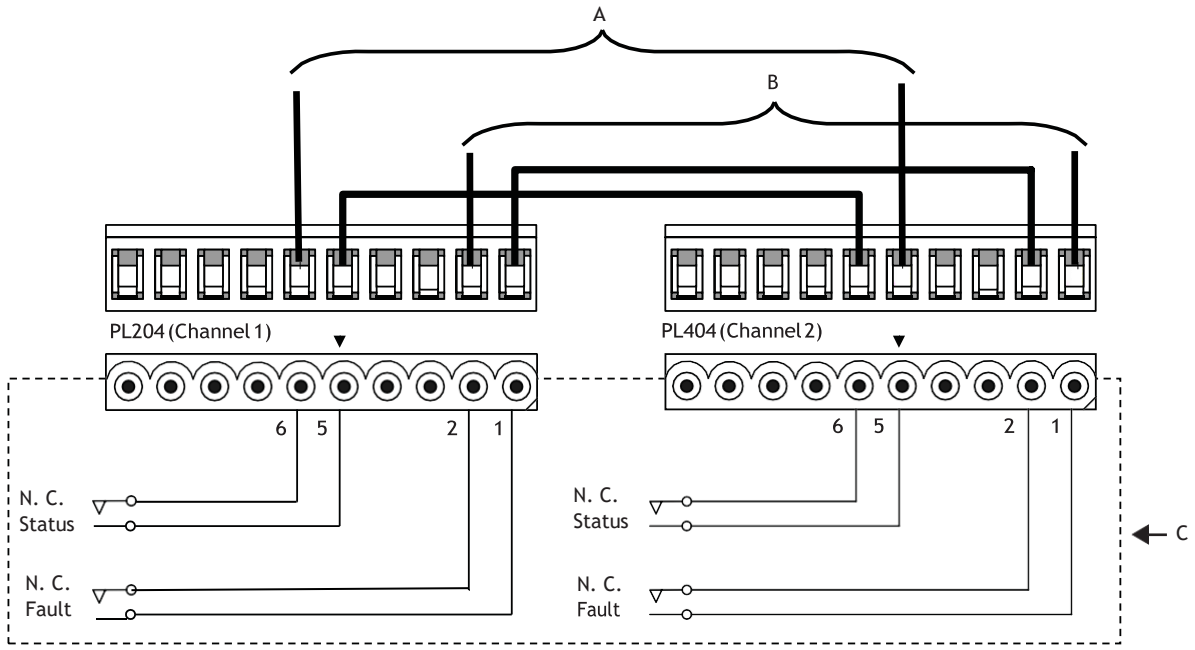
Note
In a Hydratect 2462 system, the normal state of a status or fault relay is energized and a not-normal state is de-energized. Therefore, in Figure 3-9 though Figure 3-13, the terms N.O. and N.C. refer to the relay's state when energized. See Table 1-2 and Table 1-3 on page 9 for further information about fault and status relay states.

Figure 3-9. Status, Fault and Status Reset Connections (Hydratect 2462 A and C)



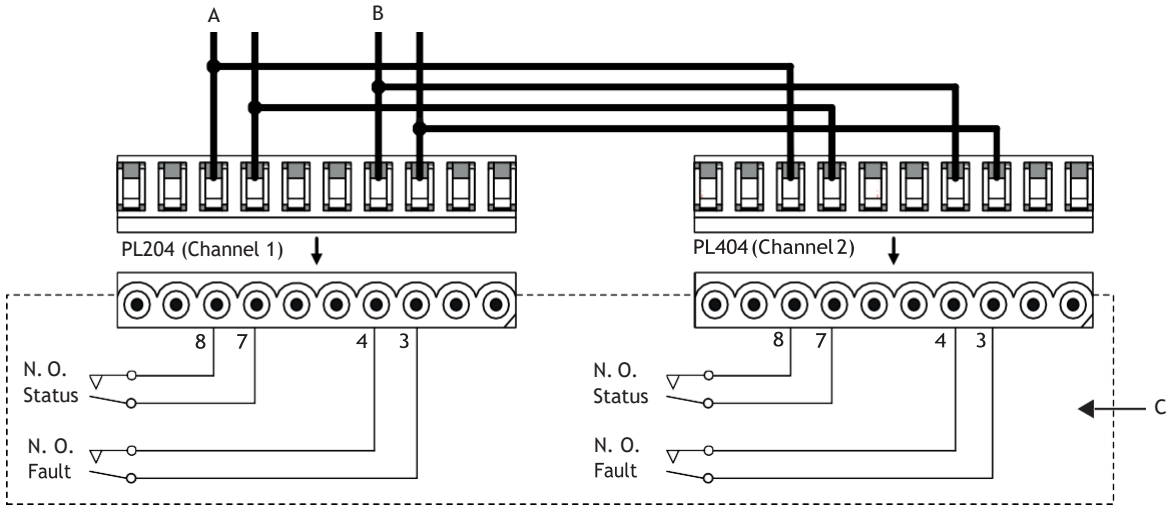
A. Status/Fault cable Klippon connector.
B. External connections (see Figures 3-10 to 3-14).
C. Latch reset switch, if required.
D. Relays shown in de-energized state (see page 9).
E. PL204 (Channel 1) or PL404 (Channel 2) on control unit.

Figure 3-10. 'One-out-of-two' Configuration Using Normally-closed Contacts (Hydratect 2462 A and C)



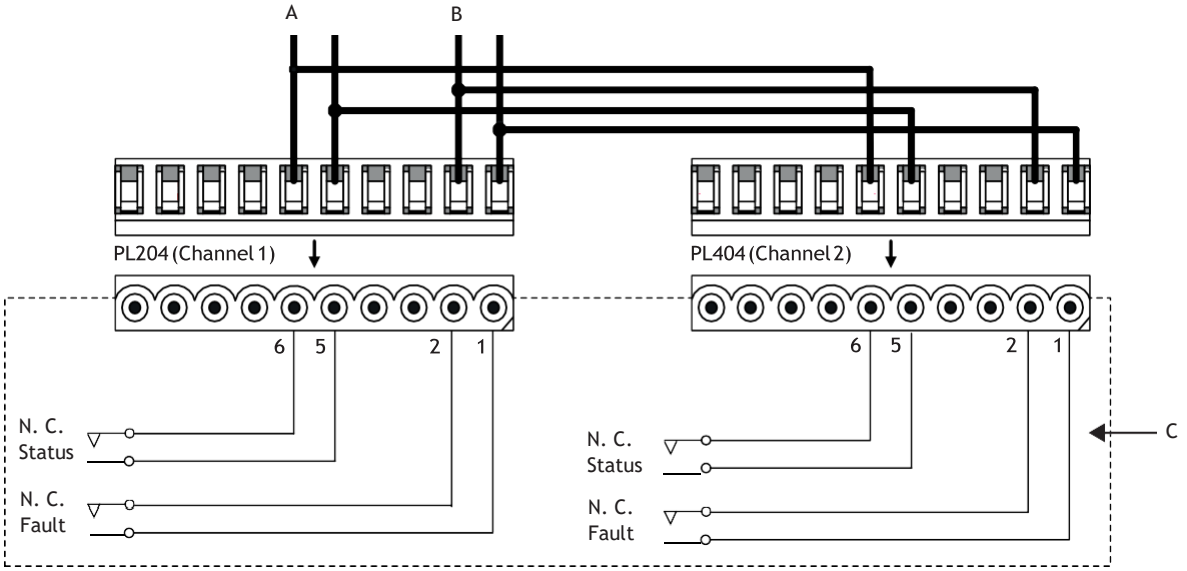
A. To trip device.
B. To alarm annunciator.
C. Relays shown in de-energized state (see page 9).

Figure 3-11. 'One-out-of-two' Configuration Using Normally-open Contacts (Hydratect 2462 A and C)



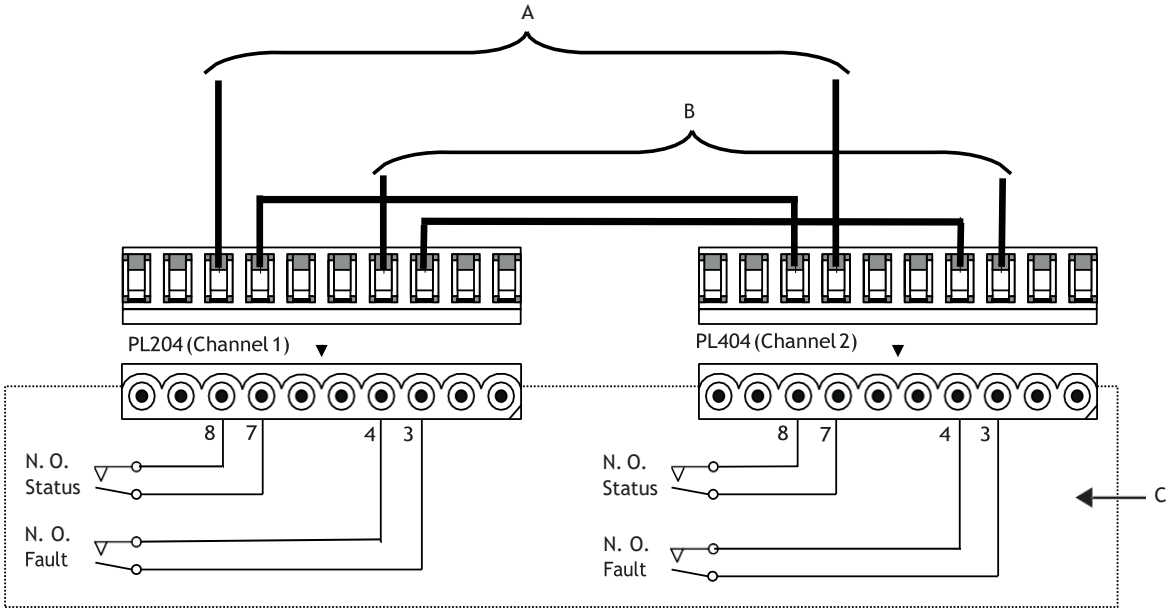
A. To trip device.
B. To alarm annunciator.
C. Relays shown in de-energized state (see page 9).

Figure 3-12. 'Two-out-of-two' Configuration Using Normally-closed Contacts (Hydratect 2462 A and C)



A. To trip device.
B. To alarm annunciator.
C. Relays shown in de-energized state (see page 9).

Figure 3-13. 'Two-out-of-two' Configuration Using Normally-open Contacts (Hydratect 2462 A and C)



A. To trip device.
B. Relays shown in de-energized state (see page 9).
C. To alarm annunciator.

3.5.3 Preparing the fault and status relay cables (for the Hydratect 2462E)

The Hydratect 2462 Electronics Control Unit ("Control Unit") uses normally-open and normally-closed switch outputs for fault and status indication.

The outputs are available on a pair of 14-way Klippon connectors: PL204 and PL404.

Procedure for making connections to the switched outputs

1. Remove the front panel from the Control Unit case and store it in a safe place.

   (This is described in detail on "Fitting cable glands" on page 22. The panel has mounted on it all the electronic circuitry and must be protected against adverse conditions such as heat, dust, and static electricity).

2. Route the fault/status cable from the external equipment to the Control Unit through suitable ducting (conduit).

3. Assemble the cable gland and fit it to the underside of the Control Unit.

   Screened cables must be used. Ensure there is a good annular (ring-shaped) contact between the cable screen and cable gland. Allow for cable conductors of length 300 mm inside the Control Unit, and twist the power pairs together.

The fault and status cable should not be shared with electrode or power wires in the same cable.

4. Prepare the fault/status cable for fitting to the Klippon connector, by stripping the end of each conductor and crimping on the pins required.

   (Remove only sufficient insulation to ensure good contact. The stripped-end must be fully inserted into the pin).

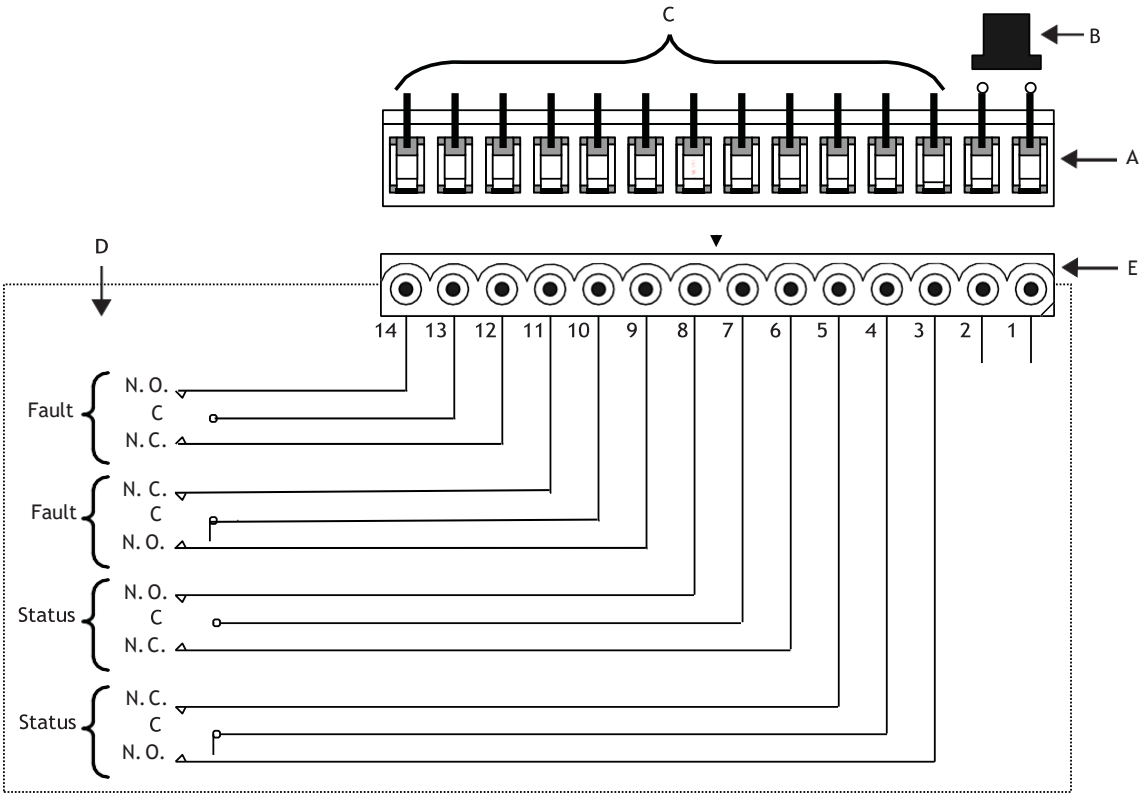
5. Fit the cable to a Klippon connector by screwing in the crimped-on pins (Figure 3-14 on page 35).

6. Repeat steps 2 to 4 for the second channel.

The fault and status cables are now ready for connection to the front panel of the Control Unit. Remember, however, that it is easier to prepare all the cables before connecting them to the front panel.

Note
In a Hydratect 2462 system, the normal state of a status or fault relay is energized and a not-normal state is de-energized. Therefore, in Figure 3-14 on page 35, the terms N.O. and N.C. refer to the relay's state when energized. See Table 1-2 and Table 1-3 on page 9 for further information about fault and status relay states.

Figure 3-14. Status, Fault and Status-reset Connections (Hydratect 2462E)



A. Status/Fault cable Klippon connector.
B. Latch reset switch, if required.
C. External connections.
D. Relays shown in de-energized state (see page 9).
E. PL204 (Channel 1) or PL404 (Channel 2) on control unit

3.5.4 Preparing the power supply cables

Each Hydratect channel has an independent power supply input that can receive power from the following sources:

- 230 Vac or 115 Vac (for Hydratect 2462A and 2462E)
- 20 Vdc to 60 Vdc (for Hydratect 2462C)

The connections for these power supplies are shown in Figure 3-15 on page 37. Connector locations are shown in Figure 3-16 on page 38.

Connection procedure

1. Remove the front panel from the Hydratect 2462 Electronics Control Unit ("Control Unit") case and store it in a safe place.

   (This is described in more detail on "Fitting cable glands" on page 22. The panel has mounted on it all the electronic circuitry and must be protected against adverse conditions such as heat, dust, and static electricity).

2. Route the power cable from the external supply to the Control Unit via a circuit breaker using suitable ducting (conduit).

3. Assemble the cable gland and fit it to the underside of the Control Unit.

   Screened cables and RF cable glands to EN61010, clause 6.10.2.2 must be used. Ensure there is a good annular (ring-shaped) contact between the cable screen and cable gland.

   Allow for cable lengths of 300 mm inside the unit. Twist the power pairs together and fit a second insulating sleeve over the wires. The Power wires must not be shared with signal wires in the same cable.

4. Prepare the power cable for fitting to a 3-way power connector, by cutting back 20 mm of outer insulating cover, stripping the end of each conductor and crimping on the pins provided.

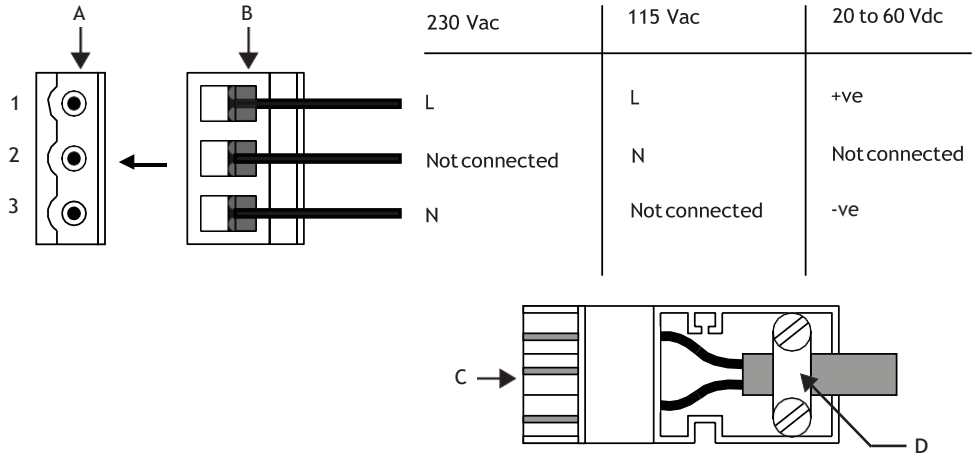
   (Remove only sufficient insulation to ensure good contact: the stripped end must be fully inserted into the pin).

5. Fit the cable to a 3-way power connector by screwing in the crimped-on pins (Figure 3-15 on page 37).

6. Now fit the power connector shroud, securing the cable outer insulation with the shroud cable clamp.

7. Repeat steps 2 to 6 for the second Hydratect channel.

Figure 3-15. Power Supply Connections



A. Connector on printed circuit board (PCB): PL101 (Channel 1) and PL301 (Channel 2).
B. Power connector.
C. Shroud half-shell.
D. Cable clamp.

3.5.5 Connecting the prepared cables to the front panel

The following procedure assumes that:

- Front panel PCB 'jumpers' have been set for all required options, as guided in "Setting the printed circuit board (PCB) jumpers" on page 23.
- Cables have been suitably prepared, as guided in previous pages.

Connecting the cables procedure

1. Take the front panel and plug the cables for Hydratect channels 1 and 2 into the relevant connectors on the PCB, referring to Figure 3-16 on page 38.
2. Connect the ground (earth) bonding lead from the case to the grounding (earthing) point on the front panel.
3. Fit the front panel of the Control Unit into the case, ensuring that no cable conductors are trapped between panel and case.
4. Secure the front panel with the four screws and four washers.

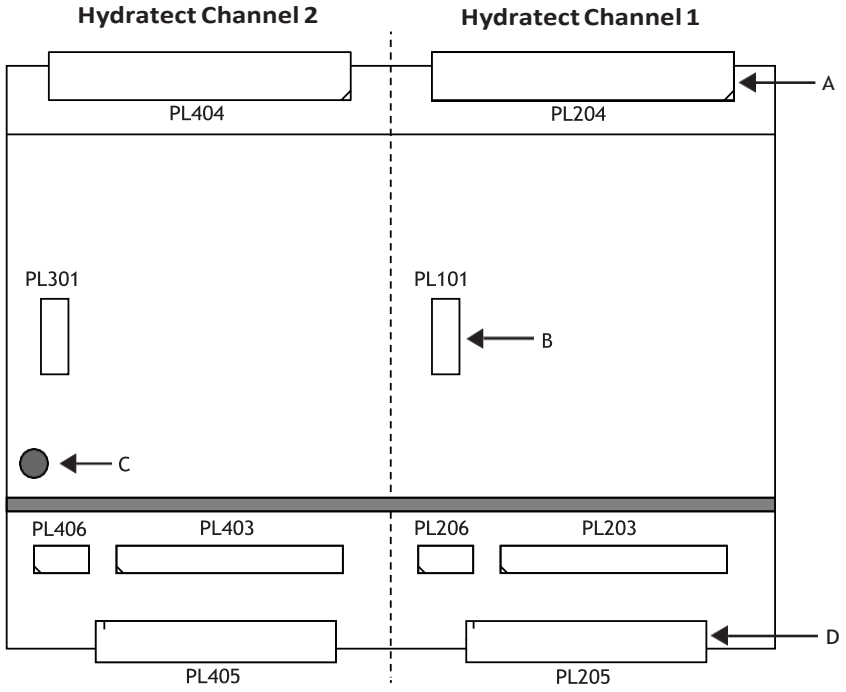
Ensure that the four washers make complete contact with the metalwork of the front panel. The label (art work) on the front panel must not be trapped under these washers.

The Hydratect 2462 system is ready for testing, as described in Section 4: System Testing.

If the installation is adversely affected by the operation of nearby equipment, then re-routing the cables to these instructions should improve performance:

- Avoid bundling the cables together.
- Ensure that cables run against earthed (grounded) metalwork, where possible.
- Use shielded (screened) cables for all connections, making sure a good annular (ring shaped) contact is made with a good quality RF cable gland.
- Do not run cables over the PCB, where possible.

Figure 3-16. Connector Locations on Front Panel PCB



A. Connector for plugging in fault and status outputs, and status reset input cable.
B. Connector for plugging in power supply connection cable.
C. Grounding (earthing) point.
D. Connector for plugging in electrode cable.

Section 4 System Testing

4.1 Test summary

Section 4 contains the procedures for testing the two basic configurations of the Hydratect 2462 system: (1) water-normal and (2) steam-normal

Use the procedures to check the operation of the Hydratect 2462 system after installation completion or any configuration change. In each procedure, checking includes the detection sensitivities and the latched fault relay facility.

The test equipment required is minimal and depends to some extent on the ancillary equipment installed in your system. You will need:

- A resistor to simulate steam presence:
  10 MΩ
- A resistor to simulate water presence:
  56 kΩ (low sensitivity) or 120 kΩ (high sensitivity).
- A resistor to simulate electrode contamination:
  270 Ω (low sensitivity) or 820 Ω (high sensitivity).
- A fault relay reset push-button.
  (This is required only when the latched relay option is configured).
- A device, such as a lamp or beeper.
  (This is to check the operation of the output contacts. The contact ratings are given in Appendix A: Specifications and Data).

  Where ancillary equipment is already connected to the output contacts, and may safely be used, it may be more appropriate to check the contact operation with that equipment.

4.2 Testing the electrodes

4.2.1 Suggested test for water-normal setting

Note
This test requires the electrode to be in its normal state (e.g. immersed in water).

1. Inspect the accessible parts of the Control Unit and cabling for any damage, and the electrode inserts and covers for any leaks or damage.

2. Bypass the safety function and take appropriate action to avoid a false trip.

   ⚠ Independent precautions must be taken to ensure that no hazard can result from this operation.

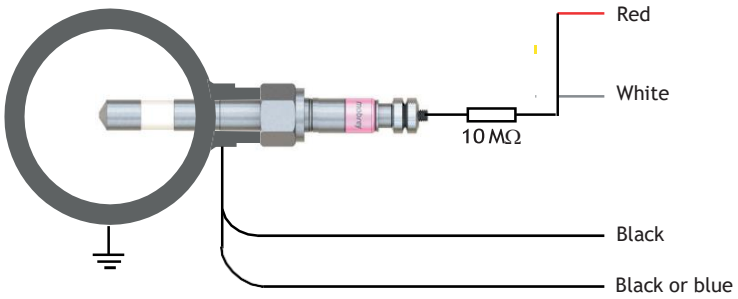
3. Verify the Control Unit jumpers are set for the required mode of operation. (See "Setting the printed circuit board (PCB) jumpers" on page 23 to check this).

4. Check the front panel LED states are as expected:

!	LED off
STEAM	LED off
WATER	LED on

5. Check the fault and status relays are as expected:
   a. Fault relay energized
   b. Status relay energized

6. To simulate the electrode in steam:
   a. Remove the white and red conductors.
   b. Place a 10 MΩ resistor in series with the electrode sense element terminal and conductors.

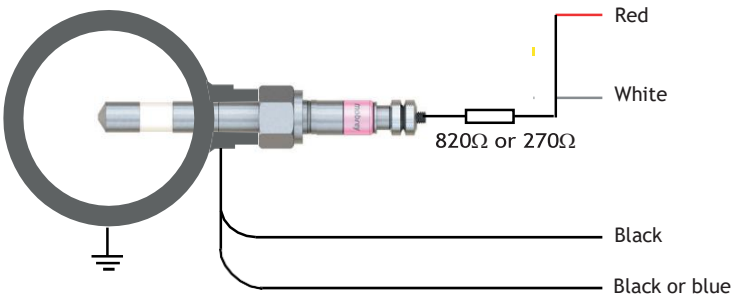


7. Check the front panel LED states are as expected:

!	LED off
STEAM	LED on
WATER	LED off

8. Check the fault and status relays are as expected:
   a. Fault relay energized
   b. Status relay de-energized

9. To simulate electrode contamination detection (if enabled), short the electrode sense element terminal to ground through an 820 Ω resistor (for High Sensitivity operation) or a 270 Ω resistor (for Low Sensitivity operation).



   Due to the electrode being exposed to steam conditions, a steam indication will be given. If the Status Relay Operation setting is set to latched, the Control Unit must first be power cycled to set the status relay back to the energized position.

10. Check the front panel LED states are as expected:

!	LED on
STEAM	LED off
WATER	LED on

11. Check on the fault and status relays are as expected:
   a. Fault relay de-energized
   b. Status relay energized

12. Remove the resistor.

   Check that the LEDs, and fault and status relays, have returned to their original states shown in steps 4 and 5.

13. Remove a knurled nut from the electrode and disconnect the white conductor.

14. Check the front panel LED states are as expected:

!	LED on
STEAM	LED off
WATER	LED on

15. Check the fault and status relays are as expected:
    a. Fault relay de-energized
    b. Status relay energized
16. Reconnect the white conductor.

    Check the LEDs, and fault and status relays, have returned to their original states as shown in steps 4 and 5.
17. Disconnect the black conductor (lead) from ground by removing the screw securing it to the manifold or, if using an insert, by removing the electrode cover base plate.
18. Check the front panel LED states are as expected:

!	LED on
STEAM	LED on
WATER	LED off

19. Check the fault and status relays are as expected:
    a. Fault relay de-energized
    b. Status relay de-energized
20. Reconnect the black conductor (lead).

    If the Status Relay Operation setting is set to latched, the Control Unit must be power cycled to set the status relay back to the energized position.

    Check the front panel LEDs, and fault and status relays, have returned to their original states as shown in steps 4 and 5.
21. Replace and secure the electrode cover.
22. Remove the safety function bypass and otherwise restore normal operation.

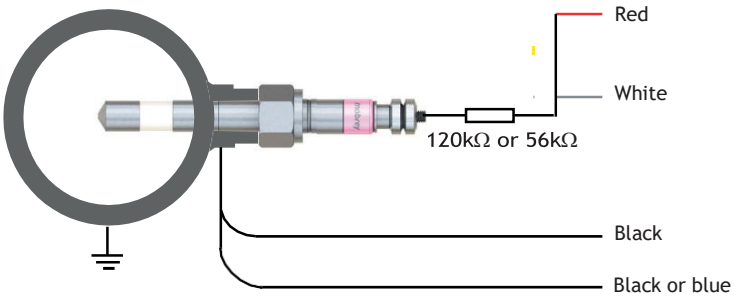
4.2.2 Suggested test for steam-normal setting

Note
This test requires the electrode to be in its normal state (e.g. immersed in steam).

1. Inspect the accessible parts of the Control Unit and cabling for any damage, and the electrode inserts and covers for any leaks or damage.
2. Bypass the safety function and take appropriate action to avoid a false trip.

   Independent precautions must be taken to ensure that no hazard can result from this operation.
3. Verify the Control Unit jumpers are set for the required mode of operation. (See “Setting the printed circuit board (PCB) jumpers” on page 23 to check this).

4. To simulate the electrode in water, remove the electrode cover and short the electrode sense element terminal to ground through a 120 kΩ resistor (when configured for High Sensitivity operation) or a 57 kΩ resistor (when configured for Low Sensitivity operation).



5. Check the front panel LED states are as expected:

!	LED off
STEAM	LED off
WATER	LED on

6. Check the fault and status relays are as expected:
   a. Fault relay energized
   b. Status relay de-energized

7. To check system operation in steam, remove the resistor.

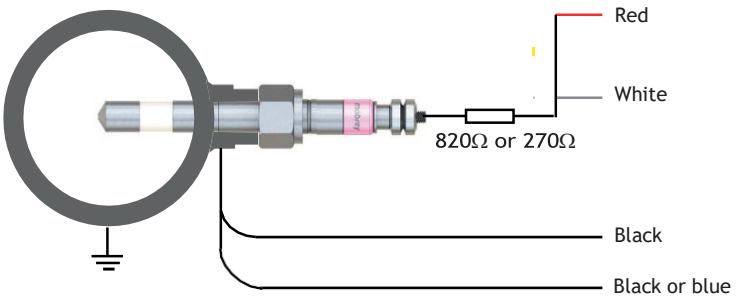
   If the Status Relay Operation setting is set to latched, the Control Unit must be power cycled to set the status relay back to the energized position

8. Check the front panel LED states are as expected:

!	LED off
STEAM	LED on
WATER	LED off

9. Check the fault and status relays are as expected:
   a. Fault relay energized
   b. Status relay energized

10. To simulate electrode contamination detection (if enabled), short the electrode sense element terminal to ground through an 820Ω resistor (for high sensitivity operation) or a 270Ω resistor (for low sensitivity operation).



11. Check the front panel LED states are as expected:

!	LED on
STEAM	LED off
WATER	LED on

12. Check the fault and status relays are as expected:
    a. Fault relay de-energized
    b. Status relay de-energized

13. Remove the resistor.

    If the Status Relay Operation setting is set to latched, the Control Unit must be power cycled to set the status relay back to the energized position.

    Check that the LEDs, and fault and status relays, have returned to their original states as shown in steps 8 and 9.

14. Remove a knurled nut from the electrode and disconnect the white conductor.

15. Check the front panel LED states are as expected:

!	LED on
STEAM	LED off
WATER	LED on

16. Check the fault and status relays are as expected:
    a. Fault relay de-energized
    b. Status relay de-energized

17. Reconnect the white conductor.

    If the Status Relay Operation setting is set to latched, the Control Unit must be power cycled to set the status relay back to the energized position.

    Check that the LEDs, and fault and status relays, have returned to their original states as shown in steps 8 and 9.

18. Disconnect the black conductor (lead) from ground by removing the screw securing it to the manifold or, if using an insert, by removing the electrode cover base plate.

19. Check the front panel LED states are as expected:

!	LED on
STEAM	LED on
WATER	LED off

20. Check the fault and status relays are as expected:

    a. Fault relay de-energized
    b. Status relay energized

21. Reconnect the black conductor (lead).

    Check the front panel LEDs, and fault and status relays, have returned to their original states as shown in steps 8 and 9.

22. Replace and secure the electrode cover.

23. Remove the safety function bypass and otherwise restore normal operation.

Section 5 Electrodes Servicing

5.1 Service summary

Section 5 describes the servicing procedure that must be followed to ensure continued and trouble-free operation of the Hydratect 2462 system.

Electrodes should be examined periodically to ensure that each one is fully serviceable, as described in "Periodic check" on page 47, Faults discovered during a periodic check must be repaired in accordance with the procedure described in Section 5.3.

All servicing work must be done in accordance with the safety precautions listed in "Safety precautions" on page 47.

To avoid extended system downtime, it is wise to ensure the immediate availability of all spares listed in "Electrode replacement parts" on page 50.

5.1.1 Safety precautions

The following safety procedures must be observed for all service work:

- Electrodes must be serviced strictly in accordance with site practices.
- Where it is customary, obtain a 'permit to work' before starting the service.
- Ensure that any tripping action likely to occur is inhibited.
- Where automatic control actions could be initiated, these actions must be inhibited outside the Hydratect 2462 system before starting the service.
- Advise the operators of any unusual effects likely to occur during the service.
- Where operator warning alarms are fitted, operators must be informed which alarms will be affected and for how long.
- Ensure that you know the correct procedures before starting the service.
- Wear industrial gloves when working on the electrodes and associated fittings.

5.2 Periodic check

A periodic check should be made (monthly, for example) to ensure the electrodes, manifolds and cables are in a serviceable condition. This examination should reveal any faults that are obvious from the electrode exterior. Faults must be repaired as described in "Repairing an electrode" on page 48.

The condition of the electrode insulator, within the pipe, is monitored continuously by the Hydratect 2462 Electronics Control Unit. Whenever the electrode insulator becomes contaminated, the alarm LED is illuminated and the alarm output is switched to the fail-safe (alarm) state. The electrode must then be cleaned as described in "Repairing an electrode" on page 48.

Recommended periodic check procedure

1. Inspect the electrode covers and cables.

   Any damaged item must be removed and a serviceable replacement part fitted. Standard replacement parts are listed in "Electrode replacement parts" on page 50.

2. Loosen the cable glands on the electrode covers. Remove screws securing the cover, and then ease the cover away from the manifold (or insert). This action reveals the electrode.

3. Remove any dust accumulation with a soft brush.

4. Inspect the electrodes for correct sealing and freedom from damage.

   An electrode fault, such as a leaking seal or a damaged electrode, must be repaired as described in "Repairing an electrode" on page 48.

   A faulty seal is indicated by wisps of steam, which appears to come from the external ceramic insulator (of the electrode) or from the electrode nut. Steam will always tend to emanate from a leak, even if the electrode is immersed in water. This is due to the temperature in a pressurized system causing water to flash-off to steam as it reaches ambient pressure.

5. Check the electrode connections are in good condition and are tightly secured. Tighten any loose connection.

6. Re-fit and secure the electrode cover. after ensuring that the electrode, electrode mounting, and electrode cables are in a serviceable condition.

7. Tighten the electrode cable glands.

This periodic check is now complete.

5.3 Repairing an electrode

An electrode must be removed for repair or replacement if it has any of the following faults:

- Contaminated insulator
- Defective seal
- Mechanical damage

Note
To ensure that electrodes fitted to multiple-port manifold are reconnected correctly after service, complete work on one electrode before moving on to the next.

⚠CAUTION

Do not attempt to cure a defective seal simply by tightening the electrode nut.

Repair procedure

1. Isolate and drain the pipe on which the electrode is mounted, following the safety precautions listed in "Safety precautions" on page 47.
2. Loosen the electrode cable glands (if applicable) and remove the electrode cover.
3. Disconnect conductors (leads) from the electrode, undo the electrode nut, and carefully remove the electrode from the port.
4. Ensure the electrode port bore is free of loose particles.
5. Check the seating face of the port.

   A scored or eroded seating face can be re-cut to an acceptable standard using the appropriate service tool listed below:

   Service Tool 246791AA (for use with electrodes 246785A and 246785Z only)
6. If there is obvious damage to the electrode, replace it with a new electrode:
   a. Carefully remove new electrode from the packaging and check it is undamaged. (In the event of discovering any damage, contact Delta Mobrey for replacement of the defective item).
   b. Proceed to step 8.
7. If there is obvious contamination and/or a defective seal:
   a. Examine the seating surface of the electrode, to ensure that it is clean and free from surface deterioration.
   b. If the electrode is able to perform an effective seal then it can be used again. However, to ensure absolute cleanliness, wipe the internal insulator (of the electrode) with a clean cloth.
   Alternatively, if the seating surface is eroded, or if there is a possibility of a leak through the external insulator, replace it with a new electrode. Return to step 6(a).
8. Clean the threads of a port, prior to fitting an electrode.
9. To alleviate thread seizure problems, lightly coat the thread of the insert with anti-seize compound (part number 830007220).
10. Ease the electrode into the insert and then turn the fixing nut of the electrode, clockwise, with your fingers to engage the threads.
11. Using a long-reach 25 mm AF socket spanner, gradually tighten the electrode fixing nut until the electrode will not rotate in its' seat.
12. Finally, tighten the electrode nut a further $^{1}/_{8}{}^{th}$ to ¼ turn to complete the procedure.
    For a high pressure electrode, the final $^{1}/_{8}{}^{th}$ to ¼ turn corresponds to a torque level of between 28 lb.ft (35 Nm) and 47 lb.ft (60 Nm). The $^{1}/_{8}{}^{th}$ turn is the recommended tightening condition, a ¼ turn is the maximum allowable, and the

tightening torque used must be the minimum to achieve this. Failure to comply with this limitation may cause damage to the port or to the electrode from over tightening.

13. Re-connect conductors (leads) to the electrode.

14. Repeat steps 3 to 13 for any other electrode in need of repair or replacement.

15. Replace the electrode cover and secure.

16. If applicable, tighten the electrode cable glands.

This completes the procedure.

5.4 Periodic system overhaul

During a system overhaul, the Hydratect 2462 system must be protected against mechanical damage. Protect it using any rigid material, such as packing cases, that prevents impact damage.

When the system overhaul is complete, remove the protective material and use the periodic check procedure (on page 47) to verify the correct operation of the Hydratect 2462 system.

5.5 Electrode replacement parts

The electrode replacement parts listed here should be readily available, on site, whenever a periodic check takes place or electrode repairs are made.

- Spare electrodes
  (see Section 2: Installing the electrodes for part numbers)
- Spare electrode cables
  (see Section 3: Installing the Electronics Control Unit for part numbers)

Section 6 Electronics Servicing

6.1 Fault diagnosis

Electrical and electronic faults in the Hydratect 2462 system are indicated by the LEDs on the front panel and by the fault and status output. Table 6-1 and Table 6-2 are lists of faults and fault symptoms that can be diagnosed from these LED indications.

Table 6-3 lists the test point values for a serviceable logic card (24620502). The test points are located on PL206 (Channel 1) and PL406 (Channel 2). The logic card is not functioning correctly if measured values are very different from values in Table 6-3.

Table 6-1. Water-normal Faults and Fault Symptoms

Fault summary	Front panel LEDs			Output relays	
	!	Steam	Water	Fault	Status normal
Power supply loss	Off	Off	Off	De-energized	De-energized
Electrode contaminated or short-circuited	On	Off	On	De-energized	Energized
Connection to electrode sense element broken	On	Off	On	De-energized	Energized
Connection to electrode ground broken	On	Off	On	De-energized	Energized
Connection to ground sense broken (electrode in water)	On	Off	On	De-energized	Energized
Connection to ground sense broken (electrode in steam)	On	On	Off	De-energized	De-energized

Table 6-2. Steam-normal Faults and Fault Symptoms

Fault summary	Front panel LEDs			Output relays	
	!	Steam	Water	Fault	Status normal
Power supply loss	Off	Off	Off	De-energized	De-energized
Electrode contaminated or short-circuited	On	Off	On	De-energized	De-energized
Connection to electrode sense element is broken	On	Off	On	De-energized	De-energized
Connection to electrode ground is broken	On	Off	On	De-energized	De-energized
Connection to ground sense broken (electrode in water)	On	Off	On	De-energized	De-energized
Connection to ground sense broken (electrode in steam)	On	On	Off	De-energized	Energized

Table 6-3. Test Point Values

Test points	Pin number	Normal state
PL206 (Channel 1) PL406 (Channel 2)	1	-6.0 V
	2	-5.4 V
	3	0 V
	4	20 Hz, ±6 V
	5	Status reference(1)
	6	-5.7 V
	7	Error reference(2)
	8	20 Hz, ±6 V
	9	+ 5.7 V
	10	+ 6.0 V

1. Water-normal, low sensitivity: 20 Hz. -6 to +3.1 V
   Water-normal, high sensitivity: 20 Hz, -6 to +4.1 V
   Steam-normal, low sensitivity: +3.1 V
   Steam-normal, high sensitivity: +4.1 V
2. Low sensitivity: +41 mV
   High sensitivity: +120 mV

6.2 Correcting a fault

Correcting a Hydratect electrical or electronic fault on-site is limited to making good any faulty electrode connections or replacing a faulty card.

6.2.1 Correcting a power loss fault

Correction procedure

1. Check that external power is being supplied to the Hydratect 2462 Electronics Control Unit ("Control Unit"). If it is not, reinstate the supply.
2. If the Control Unit is receiving power, but indicating a power loss:
   a. The power supply card (24620501 or 24620511) is faulty.
   b. The logic card (24620502) has a fault that is reducing the power supply card output.
3. Switch off the external power supplies to the Control Unit.
4. Undo the two screws securing the front panel of the Control Unit, and then carefully withdraw the front panel from the case.
5. Remove the connectors from the power supply and from the logic card.
6. Remove the power supply card and the logic card.
7. Return the power supply card and logic cards to Delta Mobrey Limited for servicing.

8. Fit a new logic card and a new power supply card, securing these with the threaded pillars and screws removed in step 5.

9. Re-fit the connectors to the power supply and logic cards, ensuring the connections are made correctly to each channel.

10. Switch on the external supplies to the Control Unit, and then check the system as described in Section 4: System Testing.

6.2.2 Correcting electrode connection faults

Correction procedure

1. Switch off the external power supplies to the Hydratect 2462 Electronics Control Unit ("Control Unit").

2. Loosen the cable gland on the electrode cover.

3. Draw back the cable cover to reveal the electrode connections.

4. Check the cable connections.

5. Tighten any connection that is loose. Re-connect any lead that has broken off.

   Remember that all connections to the electrode must be made individually. Do not twist any two (or more) wires together. The ground and ground-sense, for example, must be made to separate ground screws.

6. Replace the cable cover and secure.Tighten the cable gland.

7. Switch on the external power supplies to the Control Unit, and then check the system as described in Section 4: System Testing.

8. Switch off the external power supplies if there is still a connection fault.

9. Undo the two screws securing the front panel of the Control Unit, and then carefully withdraw the front panel from the case.

10. Check the electrode connections to the logic card.

11. Tighten any loose connections and remake any broken connection.

12. Replace and secure the front panel.

13. Switch on the external power supplies to the Control Unit, and then check the system as described in Section 4: System Testing.

14. If there is still a connection fault, it must be located in the cable itself. Switch off the external power supplies.

15. Remove the faulty electrode cable and connect a new one, as described in Section 3: Installing the Electronics Control Unit.

16. Switch on the external power supplies to the electronics unit, and then check the system as described in Section 4: System Testing. There should now be no further problem.

6.3 Electrode contamination

A contaminated electrode may be cleaned as described in Section 5: Electrodes Servicing.

6.4 Electronic component failure

When on-site, an electronic component failure can be repaired only by removing the logic card and fitting a new card.

Logic card replacement procedure

1. Switch off the external power supplies to the Hydratect 2462 Electronics Control Unit ("Control Unit").

2. Undo the two screws securing the front panel of the Control Unit, and then carefully withdraw the front panel from the case.

3. Remove the connectors from the power supply and from the logic card.

4. Remove the power supply card and the logic card. Five screws and five threaded pillars must be removed to do this.

5. Return the logic card to Delta Mobrey Limited for servicing.

6. Fit a new logic card and the original power supply card, securing these with the threaded pillars and screws removed in step 4.

7. Re-fit the connectors to the power supply and logic cards, ensuring the connections are made correctly to each channel.

8. Switch on the external power supplies to the Control Unit, and then check the system as described in Section 4: System Testing.

6.5 Electronic replacement parts

Table 6-4 lists the replacement parts recommended to be kept readily available on-site in the event of an electronics failure.

Table 6-4. Replaceable Parts

Hydratect variant	PSU board	Logic board	Fuse
2462A	24620501B	24620502A	360190350
2462C	24620511B	24620502A	K9633
2462E	24620503B	24620504A	360190350

Appendix A Specifications and Data

A.1 Specifications

A.1.1 General

Product

- Hydratect 2462 Steam/Water Detection System

Electrode channels

- Two channels

Water/Steam threshold

- 0.6 µS/cm (normal) or 1.6 µS/cm (alternate)

A.1.2 Display

Integral display

- One red LED for indication of steam
- One green LED for indication of water
- One amber LED for indication of a fault

A.1.3 Electrical

Power supply (ac) on Hydratect 2462A/E

- 94 to 130 V or 187 to 256 V, 48 to 65Hz
- 2 x 10 VA maximum
- Fuse: 63 mA (Fast), 20 mm

Power supply (dc) on Hydratect 2462C only

- 20 to 60 V
- 2 x 200 mA maximum
- Fuse: 1.25 A (Time delay), 20 mm

Electrical connectors

- Plug-in screw terminals
- Maximum gauge: 16 AWG (1.5 mm^2)
- Terminal torque 0.5 to 0.6 Nm

Electrode cable length

- 30 m (98 ft.) maximum

Fault detection capabilities

- Broken wire to electrode and short-circuit to ground
- Any component failure to prEN50156

Status relay output (one per channel)

- Energized for steam- or water-normal status
- Separate normally-open and normally-closed contacts
- Hydratect 2462A and 2462C:
  250 Vac or 125 Vdc maximum switched voltage,
  8 A maximum switched current,
  (8 Adc @ 30 V dc, 1.08 Adc @ 60 Vdc, 0.2 Adc @ 125 Vdc),
  2000VA ac (resistive load) maximum
- Hydratect 2462E (two-pole changeover):
  250 Vac, 8 A maximum, 225 Vdc, 0.25 A

Fault relay output (one per channel)

- Energized during normal operation (fail safe)
- Other specifications same as status relay output

A.1.4 Mechanical

Enclosure

- 7.5 in. x 7.5 in. x 3.5 in. (190 mm x 190 mm x 90 mm)
- Stainless steel, grade 304 (natural finish)
- Wall mounting, two point
- IP65 / NEMA 4X

Weight

- 2.8 kg (6.2 lb)

A.1.5 Environmental

Operating temperature

- -20 to +70 °C (-4 to 158 –F)

Relative humidity

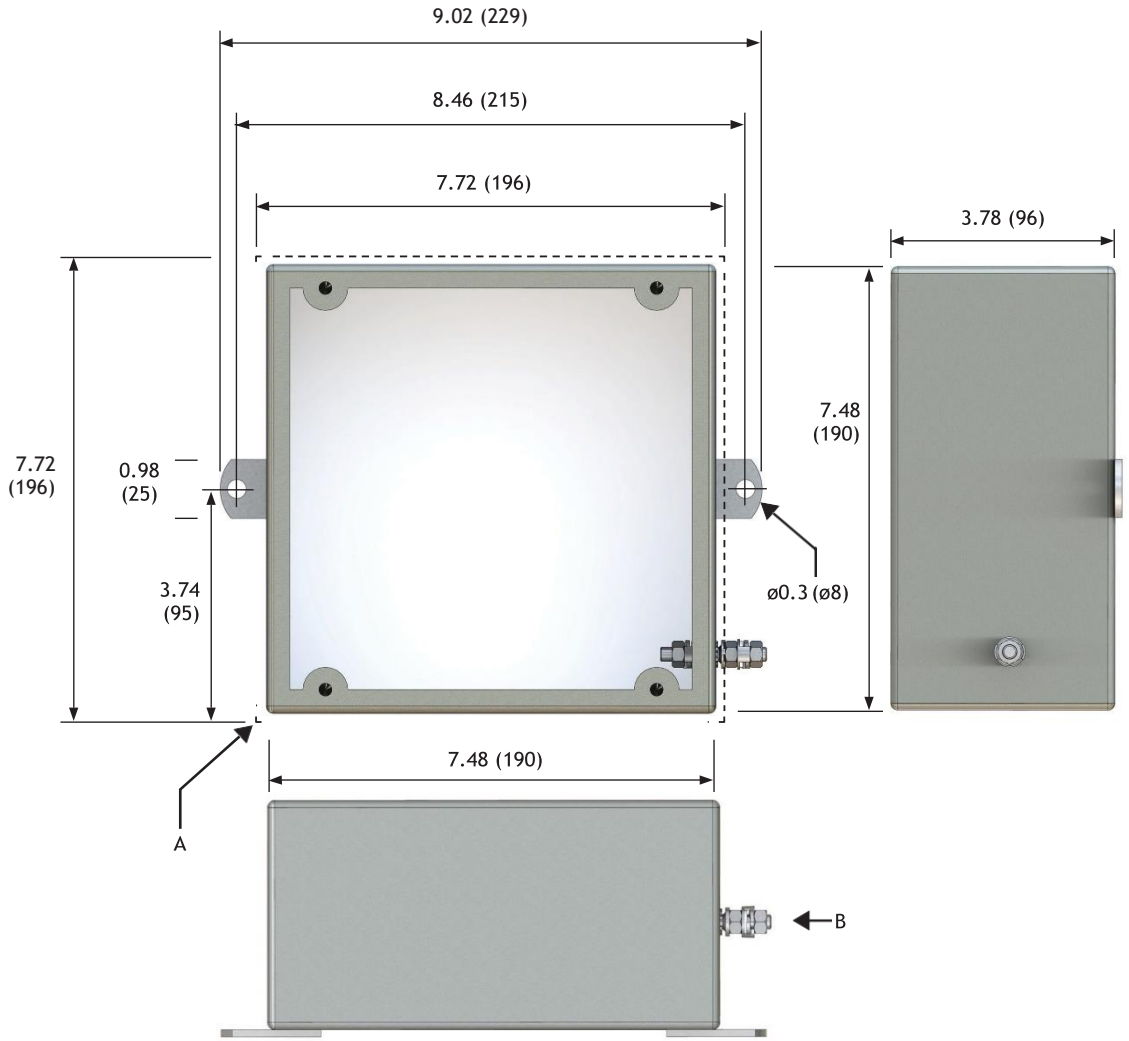
- Up to 100%

A.1.6 Approvals

- FM (approved for steam-system water detection)
- LVD
- PED (safety accessory)
- EMC
- ATEX

A.2 Dimensional drawing

Figure A-1. Hydratect 2462 Electronics Control Unit



A. Outline of front panel.
B. M6 earth/ground stud.

Dimensions are in inches (mm).
Overall depth = 100 mm (case and panel) + 3 mm (brackets) + 4.5 mm (bolt heads and washers)

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