MTL901 ESD link (ATEX)

Instruction Manual

INM901

Contents

IMPORTANT NOTICE

From February 2011 onwards, the SIG03 and SIG08 Pendants are fitted with a new 5-pin plug that replaces the (now obsolete) 6-pin version, and all new SIG02, SIG10 and SIG11 assemblies are fitted with the new 5-pin socket.

This means that any replacement Pendants ordered after this time will not be compatible with existing SIG02, SIG10 and SIG11 assemblies manufactured before this date.

For backward compatibility, a modification kit has been created and is available for purchase under the part number SIG12, which includes a 5-pin socket, complete with mounting fixtures, and 0.5 metre flying leads for fitting into existing SIG02, SIG10 and SIG11 assemblies. This can easily be retrofitted onsite by following the instructions contained in this manual. See Section 7.

1 INTRODUCTION

Transferring liquefied gas between a ship and the shore or vice versa is potentially hazardous. If any problems occur during such a transfer operation, not only should pumping cease immediately, but valves to isolate the transfer pipeline should then be closed in a predetermined sequence.

This sequence follows recommendations by SIGTTO (Society of International Gas Tanker and Terminal Operators) and is controlled by equipment on the tanker and on shore.

To enable this emergency shut down (ESD) procedure to be initiated either from the ship or from the shore, there needs to be some link-up which operates safely in an environment where there may be an escape of gas. This is provided by the MTL901 ESD link whose installation and operation is described in this manual.

While employing electricity as a signalling medium, MTL901 embodies the principles of 'intrinsic safety' whereby voltages and currents in areas where flammable gas may be present are kept to levels at which sparks cannot cause ignition.

The concept of intrinsic safety also includes isolating devices which will switch an adjoining circuit without the need for a direct electrical link. This removes the possibility of high voltages or currents entering the hazardous area.

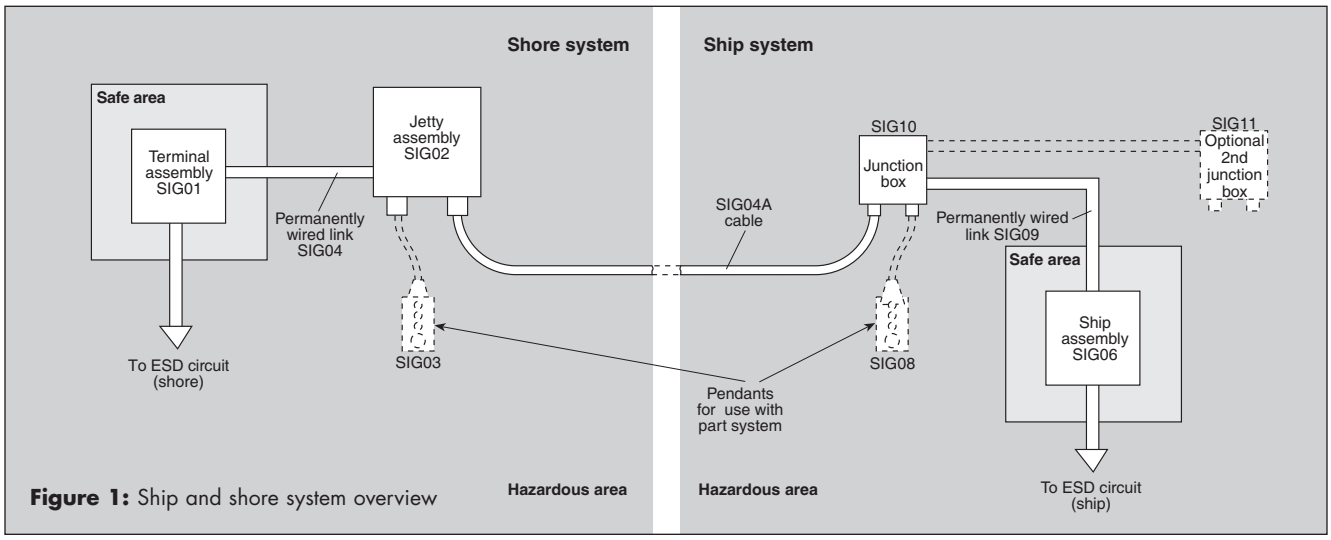


Figure 1: Ship and shore system overview

2 SYSTEM DESCRIPTION

This describes the MTL901 ESD link system as a series of 'black boxes' with little attempt to describe the internal details. A fuller technical description - along with a justification of the intrinsic safety aspects of the design - is included in the Application Note AN9012 which can be obtained from MTL.

The complete system consists of three main elements as shown in Figure 1. Two of those elements are permanently mounted on-shore; the other element is permanently mounted on board ship. They are linked together by a cable forming a ship-to-shore link.

2.1 Shore system

The shore system consists of a Terminal Assembly (SIG01) mounted in a safe area on land and a Jetty Assembly (SIG02) mounted as near to the edge of the jetty as practical to receive the ship-to-shore link. The Jetty Assembly also plays a part in checking the correct functioning of the system and, because it is in a potentially hazardous area, is designed on intrinsic safety principles.

2.2 Ship system

The principal element within the ship system is the Ship Assembly (SIG06) mounted in a safe area on board ship. This links with a Junction Box (SIG10) on deck into which the ship-to-shore link can be plugged. On large ships, two Junction Boxes can be used; one either side of the ship. Both the shore Terminal Assembly (SIG01) and the Ship Assembly (SIG06) are linked to their respective ESD circuits which control the required pumps and valves.

2.3 Part systems

There are situations where a fully equipped terminal has to receive a non-equipped ship; or where a fully equipped ship docks at a non-equipped terminal. For these, there is also a Pendant which, in part, mimics the missing part of the system. This plugs in to a separate socket labelled PENDANT either on the Jetty Assembly or on the Junction Box on the ship whichever is required.

The Pendant has an emergency button with a **PULL to STOP** action to prevent inadvertent operation. It also has a green LED to indicate correct operation and a red LED and a buzzer to indicate an emergency situation.

The Pendant accompanying each land-based and ship-based system will be stored in some suitable locker where the cable can be properly coiled. When storing the Pendant on board ship, the following should be noted. On the Ship Assembly (SIG06) the RUN/TEST keyswitch should be in the TEST position. With no Pendant connected, the red EMERGENCY SHUTDOWN LED will remain illuminated. However, in a ship's control room, a red light indicates an alarm condition, and so this is not normally acceptable. To extinguish the red LED the output terminals 10 and 11 (wires 14 and 15) on Unit 4 within the SIG06 assembly (see Figure 9 & 14), should be bridged. This can be accomplished by an external keyswitch 'HARBOUR/SEA' which is fitted on some ships. The keyswitch must also illuminate a yellow warning indicator to remind the operator that he has selected the 'AT SEA' mode

3 SYSTEM INSTALLATION

These instructions provide information on the physical installation of the various assemblies that make up the whole system.

(For more information on safe and hazardous areas see AN9003 'A user's guide to intrinsic safety'. Where information is required on other aspects of the philosophy behind the system, consult other MTL documents such as AN9012 'A user's guide to the MTL901 ship to shore ESD link for liquefied gas cargo transfer'.) For part system – SHIP with Pendant refer to Instruction Manual INM901A.

In a few places in the following sections, the instructions for the shore system and the ship system duplicate themselves. This is to enable the staff installing either part of the system to do so without continual cross reference. Each section tries to deal with topics such as initially checking the equipment against the parts list through to commissioning the whole system in approximately the sequence that would be followed by someone installing the system.

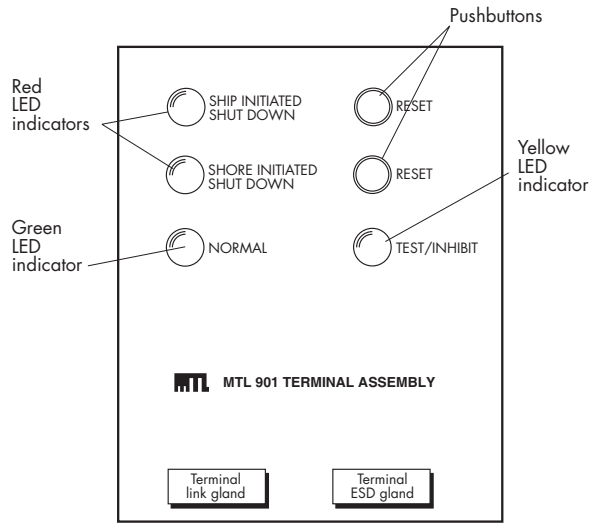


Figure 2: Terminal Assembly (SIG01)

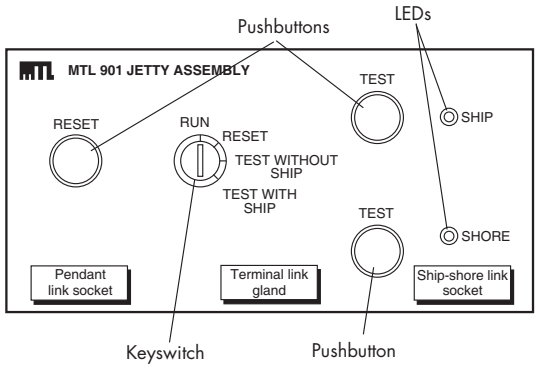


Figure 3: Jetty Assembly (SIG02)

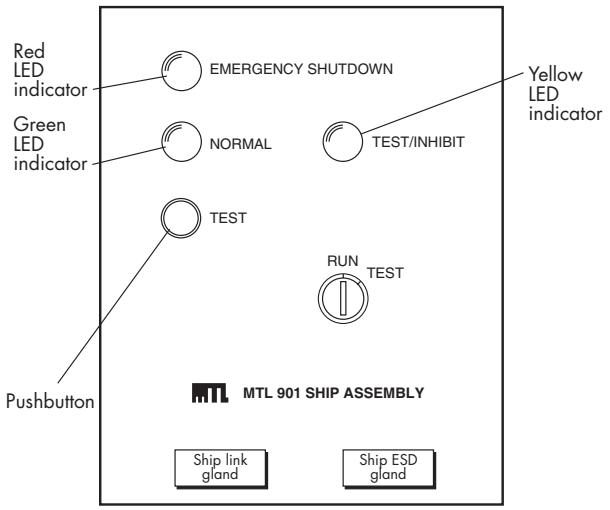


Figure 4: Ship Assembly (SIG06)

3.1 Shore system installation

3.1.1 Check list

SIG01	1-off	Terminal Assembly (see Figure 2)
SIG02	1-off	Jetty Assembly (see Figure 3)
SIG03	1-off	Emergency Stop Pendant (including cable, plug and cap)
SIG04	1-off	Cable (terminal to Jetty Assembly)
SIG04A	1-off	Cable and plugs (ship-to-shore)

3.1.2 Voltage compatibility

Open up the Terminal Assembly to check that the voltage specification on the units inside coincides with that required.

3.1.3 Cable

If the SIG04 cable hasn't been ordered, the following cable specification should be adhered to:-

- 5-core 1.5mm^2 maximum
- Max O/D 11.9mm to fit plugs and cable glands
- Unarmoured recommended to meet IS requirements (heat, oil, fire resistant).
- e.g. 3185TQ BS6500:1984 Table 9

3.2 Locating the shore-based Terminal Assembly

This is designed for mounting in a safe area away from possible flammable gas/air mixtures. It is anticipated that this would be in the main control room on the landward end of the jetty.

If no safe area is available, then the unit can be mounted in an appropriate flameproof box for Zone 1 mounting; or assessed as Zone 2 mounting according to local requirements. However, an installation of this type is undesirable as it reduces the accessibility of the equipment for maintenance purposes. It is therefore worth some considerable effort to find a safe area in which to mount this unit.

3.3 Locating the Jetty Assembly

This should be located as near to the edge of the jetty as practicable to minimise the length of the ship-to-shore cable that is vulnerable to damage. Choosing a site should take into account:-

a) The risk of mechanical damage to the assembly

b) Protection from intense direct sunlight and excessive water contact

The ideal position is in a covered control area or a booth (if available) on the end of the jetty. In all cases, the Jetty Assembly should be positioned to allow the various test procedures to be carried out in preparation for cargo transfer.

3.4 Mounting the Terminal and Jetty Assemblies

These are both designed for wall mounting and the casings incorporate four mounting holes, 5.5mm diameter, one at each corner for the purpose. The holes are accessible once the lids are removed. Dimensions of the boxes and spacings of the mounting holes are given in Figure 5.

The wall/bulkhead should be adequately strong to support the box plus any other imposed load. It is likely that M5 nuts and bolts will provide suitable fixings.

In both cases, the boxes should be mounted with the principal sockets/glands at the bottom and with adequate room to remove the plugs/install the permanent wiring. A minimum of 30cm is recommended for plug/socket connections and 20cm for permanently wired connections via glands. (These dimensions are based on the flexible cable recommended by MTL. Care must be taken if a different cable type is used.)

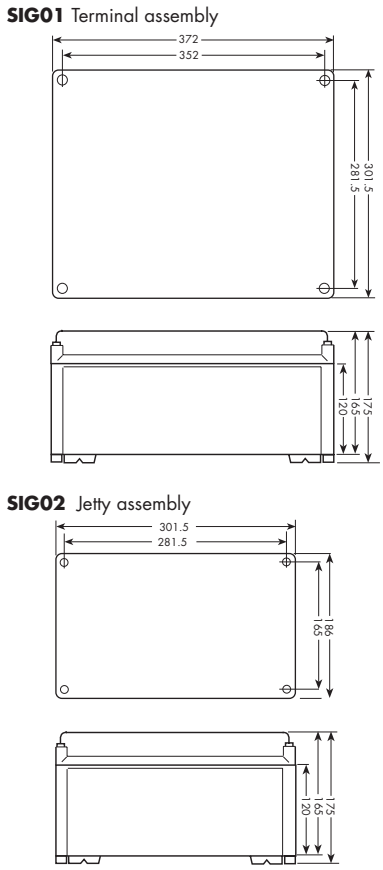


Figure 5: SIG01 and SIG02 dimensions and mounting

3.5 Shore system wiring (general)

Much of the system is permanently wired, so the interlinking cables should be mounted unobtrusively and supported along their length as required. As an unarmoured cable is recommended, protection should be given to the cable lengths wherever possible. In all cases, the cable will need to be supported to within around 0.5m of each assembly with the cable then looped or curved to minimise strain on the gland where it enters the box. Also, the plastic shrouds should be trimmed and placed on the cable before wiring through the glands.

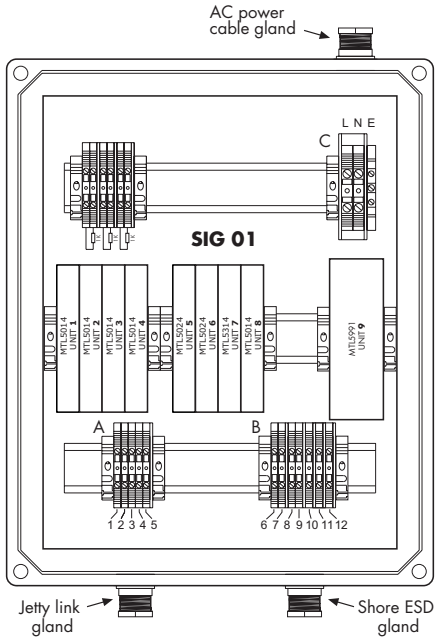


Figure 6: Terminal Assembly internal layout (SIG01)

3.6 Wiring up the Terminal Assembly

Three cable connections need to be made in order to wire up the Terminal Assembly. (See Figures 2 and 6.)

3.6.1 Terminal link gland

The cable entering the terminal link gland links terminal and jetty assemblies and should be connected to terminals 1–5 (terminal strip A in the diagram). Terminal 1 in the Terminal Assembly should be connected to terminal 7 in the Jetty Assembly, terminal 2 to terminal 8, and so on through to terminal 5 in the Terminal Assembly which is connected to terminal 11 in the Jetty Assembly.

3.6.2 Shore ESD gland

The cable entering the shore ESD gland links the MTL901 system with the shore ESD system and should be wired to terminals 6, 8,10,11,12 (terminal strip B) as follows:-

6 + 8	Output from MTL901 system to operate shore ESD system. (N/C, open on alarm ESD contact)
10, 11 + 12	Input from shore ESD system to operate MTL901 system. Input should should be a changeover relay contact with terminals 11 and 12 closed in normal operation and 10 and 11 closed on alarm/ESD

3.6.3 AC power supply gland

The AC mains supply cable should enter via the power supply gland and be connected to the 'live' (L) connection and 'neutral' (N) connection. At this point, check again that the voltage of the supply is compatible with the voltage of the unit supplied.

The unit is designed to operate in a 'double insulated' fashion. However, if there is concern about static build-up in the casing, there is an 'earth/ground' tag on the baseplate which can be linked to a properly established 'earth/ground' point nearby.

Once the wiring is complete, check that all the glands are tight and properly supporting the free lengths of cable; then replace the lid.

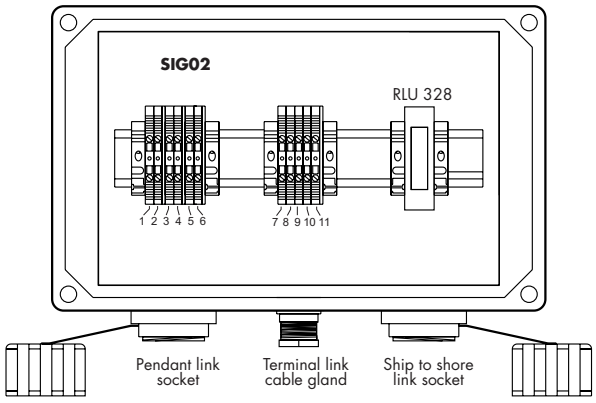


Figure 7: Jetty Assembly internal layout (SIG02)

3.7 Wiring up the Jetty Assembly

Only one cable connection needs to be made to wire up the Jetty Assembly. (See Figures 3 and 7.)

3.7.1 Terminal link gland

The cable entering the terminal link gland links the Terminal Assembly with the Jetty Assembly. Connect the individual cores to terminals 7 through to 11 in the Jetty Assembly as described in section 3.6.1.

Ensure that the free length of cable is properly supported and replace the lid.

All other connections to the Jetty Assembly are via removable plugs into the labelled sockets. If the ship-to-shore link cable has not been supplied, refer to Figure 12 to wire up the plugs provided.

3.8 Checking the operation of the shore system

This is undertaken by following the procedures used for preparing the system for use plus those for the three-month checks. These are given in part 5.

3.9 Ship system installation

3.9.1 Check list

SIG06	1-off	Ship Assembly (Figure 4)
SIG08	1-off	Emergency stop Pendant (including cable, plug and cap)
SIG09	1-off	Cable (Ship Assembly to Junction Box)
	1-off	Cable (Junction Box to additional junction box) (optional)
SIG10	1-off	Junction Box (Figure 10)
SIG11	1-off	Additional Junction Box (optional) (Figure 10)

3.9.2 Voltage compatibility

Open up the Ship Assembly to check that the voltage specification on the units inside coincides with that required.

3.9.3 Cable

If the SIG09 cable hasn't been ordered, the following cable specification should be adhered to:-

- 5-core 1.5mm^2 maximum
- Max O/D 11.9mm to fit plugs and cable glands
- Unarmoured recommended to meet IS requirements (heat, oil, fire resistant).
- e.g. 3185TQ BS6500:1984 Table 9

3.10 Locating the Ship Assembly

This is designed for mounting in a safe area away from possible flammable gas/air mixtures. An ideal place is the ship control room but any accessible safe area would be suitable.

3.11 Locating the ship Junction Box(es)

These can be mounted in a hazardous area and should be positioned as near to the loading/discharge arms of the ship as is practicable. (This will be where the ship-to-shore link cable will come across from the jetty.)

If a single Junction Box is used, then it must be in a position to accept the ship-to-shore link cable from either side of the ship. In addition, it must be possible for the Pendant (which also plugs into the Junction Box) to be taken onto the jetty from either side of the ship.

If two Junction Boxes are used, they should be positioned on the port and starboard sides of the ship as near to the ship sides as is practicable.

Where two Junction Boxes are to be used, only one of them (referred to elsewhere as the 'SIG11 Junction Box') will be wired directly to the Ship Assembly box. The other will act as a slave. Which Junction Box is used on which side will depend on the convenience of running the required cable. (However, as the mounting holes are the same for both types of Junction Box, they can be changed later in the installation procedure if it is discovered that the cable runs need to be altered.)

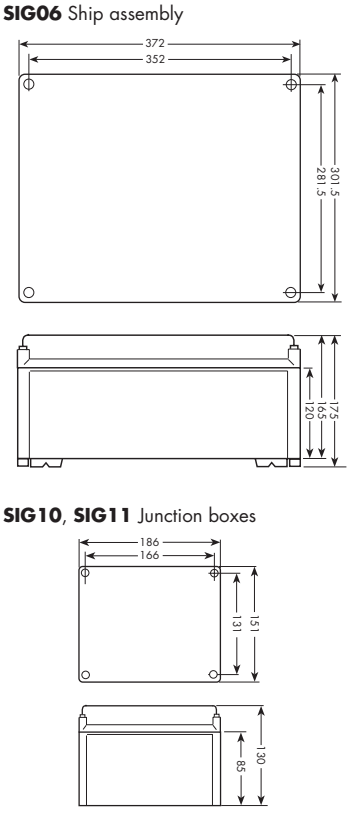


Figure 8: SIG06, SIG10 and SIG11 dimensions and mounting

3.12 Mounting the Ship Assembly and Junction Box(es)

The boxes are designed for wall mounting and incorporate four 5.5mm diameter mounting holes, one at each corner, for the purpose. The holes are accessible once the lids are removed. Box dimensions and the mounting hole spacings are shown in Figure 8.

The wall/bulkhead should be adequately strong to support the box and any other imposed load. It is likely that M5 nuts and bolts will provide suitable fixings.

All boxes/assemblies should be mounted with the principal sockets and glands at the bottom and with adequate space around them to install the permanent wiring and to remove plugs where required. A minimum of 30cm is recommended for plug/socket connections and 20cm for permanently wired connections via glands.

(These dimensions are based upon the type of flexible cable recommended here. Alternative spaceings may be required if a different cable type is used.)

3.13 Ship system wiring (general)

Much of the system is permanently wired, so the interlinking cables should be mounted unobtrusively and supported along their length in accordance with the requirements of the relevant shipping authority. As an unarmoured cable is recommended, protection should be given to the cable lengths wherever possible. In all cases, the cable will need to be supported to within around 0.5m of each assembly with the cable then looped or curved to minimise strain on the gland where it enters the box. Also, the plastic shrouds should be trimmed and placed on the cable before wiring through the glands.

3.14 Wiring up the Ship Assembly

Three cable connections need to be made to wire up the Ship Assembly. (See Figures 4 and 9.)

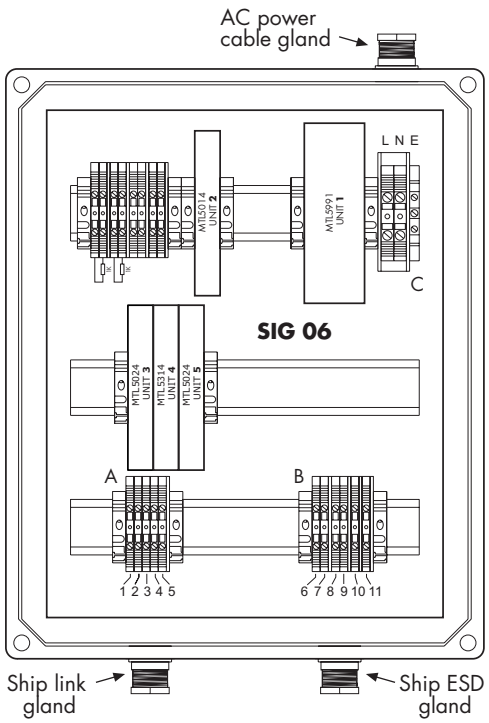


Figure 9: Ship Assembly internal layout (SIG06)

3.14.1 Ship link gland

The cable entering the ship link gland links the Ship Assembly with the Junction Box and should be wired to terminals 1–5 (terminal strip A on diagram). The way in which the individual cores connect at the Junction Box(es) is dependent on whether one or two Junction Boxes are used. (See the section on wiring the Junction Boxes.)

3.14.2 Ship ESD gland

The cable entering the ship ESD gland links the MTL901 system with the ship ESD system and should be wired to terminals 6, 8, 10 and 11 (terminal strip B) as follows:-

6 + 8	Output from MTL901 system to operate ship ESD system. (N/C, open on alarm ESD contact)
10 + 11	Input from ship ESD system to operate MTL 901 system. (N/C, open on alarm ESD contact)

3.14.3 Power supply gland

The AC power supply cable should enter via the power cable gland and be connected to the 'live' (L) connection and the 'neutral' (N) connection. At this point, check again that the voltage of the supply is compatible with the voltage of the unit supplied.

The unit is designed to operate in a 'double insulated' fashion. However, if there is concern about static build-up in the casing, there is an 'earth/ground' tag on the baseplate which can be linked to a properly established 'earth/ground' point nearby.

Once complete, check that all the glands are tight and properly supporting the free lengths of cable; then replace the lid.

3.15 Wiring up the Junction Box(es)

The wiring of the junctions boxes depends upon the configuration used. (See Figures 10 and 14.)

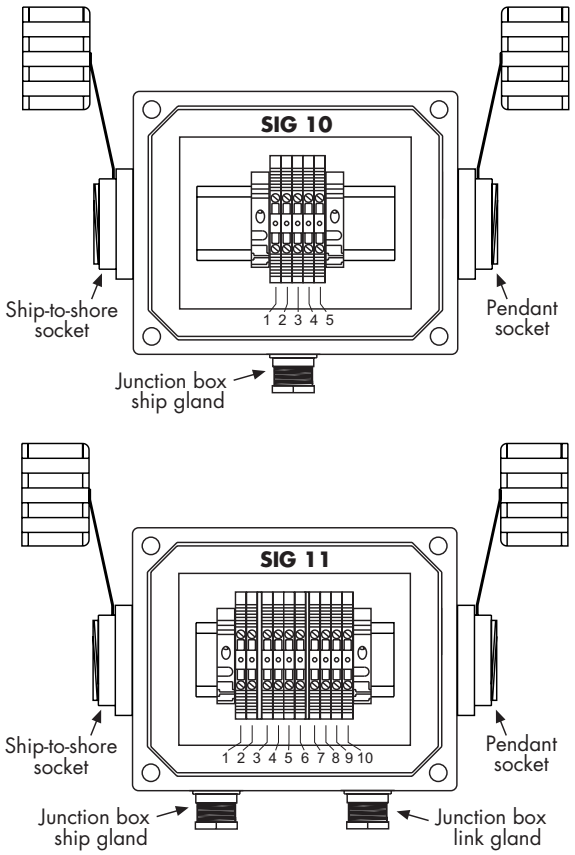


Figure 10: SIG10 and SIG11 Junction Boxes

3.15.1 Single Junction Box configuration (SIG10)

The cable entering the SIG10 Junction Box link gland links the box with the Ship Assembly. In this case, terminal 1 in the Ship Assembly should be connected to terminal 1 in the Junction Box; terminal 2 to terminal 2 and so on to terminal 5.

3.15.2 Dual Junction Box configuration (SIG10 + SIG11)

In this case, the cable runs from the Ship Assembly into the SIG11 Junction Box through the Junction Box-ship gland. A separate cable runs from the SIG11 to the SIG10 Junction Box which acts as a slave through the Junction Box link glands. The terminal connections are given below:-

Ship ass'y terminals		Junct box SIG11		Junct box SIG10
1	to	1		
2	to	3		
3	to	4		
4	to	7		
5	to	8		
		2	to	1
		5	to	2
		6	to	3
		9	to	4
		10	to	5

3.16 Checking the operation of the ship system

This is undertaken following the procedures used for preparing the system for use plus those for the three-month checks. These are given in section 5.

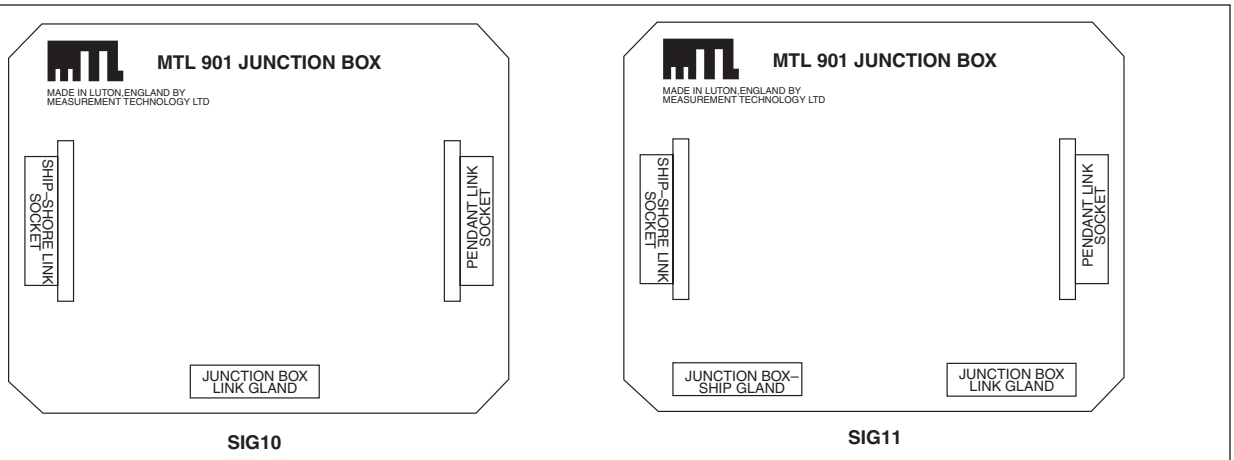


Figure 11: SIG10 and SIG11 lid assemblies

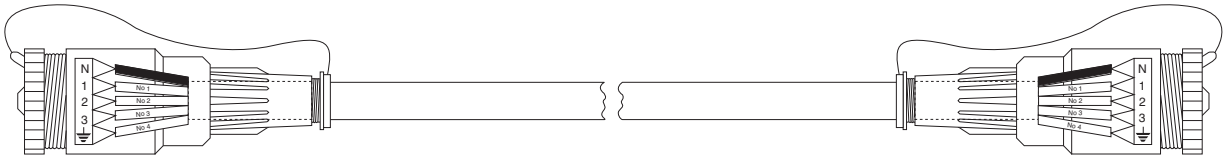


Figure 12: SIG04A Ship-to-shore cable final assembly

4 OPERATION

4.1 Normal operation (complete system)

Each time the system is used, this is preceded by a short sequence of tests to check the system and to establish the required link between ship mounted and shore mounted ESD circuits. Some of these procedures are undertaken prior to forming the link between ship and shore; others are undertaken afterwards. These procedures are described in sections 5.1 to 5.4.

During all the test procedures, yellow cluster LEDs on both terminal and ship assemblies come on to show that testing is being carried out and the output from the MTL system to both shore and ship ESD systems is inhibited.

Once the system is running and the transfer of liquified gas is underway, an emergency shut down (ESD) can be initiated on the ship or shore through conventional ESD procedures. The MTL 901 link system transfers the ESD signal from ship-to-shore or vice versa ensuring both ESD systems are brought into operation irrespective of where the signal originates.

In normal operation, both green cluster LEDs on the terminal and ship assemblies should be on, together with the two single green LEDs on the Jetty Assembly.

Once a shut-down has occurred, one of a pair of red cluster LEDs on the Terminal Assembly will come on to indicate that a shut down has occurred and from which end of the system it was initiated. This assists with detecting the cause of the shut-down if this is not immediately apparent. A red cluster LED on the Ship Assembly will also come on to indicate that a shutdown has occurred. Both green cluster LEDs will go off at this stage, together with both single green LEDs on the Jetty Assembly.

4.2 Normal operation (part system)

Whichever is the 'equipped' end of the system, the initial tests (prior to link-up) should be conducted in the same way as if it was about to be linked into a complete system. See sections 5.1 and 5.2.

If it is the ship that is equipped, the Pendant cable is then plugged into the Junction Box on the ship instead of the ship-to-shore cable. When the transfer operation is about to take place, the Pendant unit is taken on-shore to enable that ('non-equipped') end of the operation to be monitored.

If it is the shore system that is present and the ship is non-equipped, the Pendant cable is plugged into the Jetty Assembly instead of the ship-to-shore link and the Pendant unit is taken on board the (non-equipped) ship.

Once the transfer operation is underway and an emergency situation requires shut-down to be initiated from the non-equipped end of the system, the ESD procedure at that end is initiated manually. The ESD procedure at the fully-equipped end of the system is initiated by the observer at the non-equipped end pulling the stop button on the Pendant.

If shut-down is initiated from the fully equipped end of the system, the red LED and buzzer on the Pendant will give warning to initiate manually the ESD procedure on the 'non-equipped' end.

4.3 Ship-to-shore cable

This is normally considered to be part of the terminal equipment and is stored with the Pendant unit.

4.4 Resetting the system

After shut-down, and once those responsible have assured themselves that the cause has been safely dealt with, and that the ship and shore ESD systems have been reset, the MTL901 link system itself can be reset to allow the transfer operation to continue. To reset the system after shutdown:–

a) Ensure that the ship and shore ESD systems have been reset.

b) Press the RESET button on the Jetty Assembly. Both green LEDs on the Jetty Assembly should come on and the red cluster LED on the Ship Assembly will go off automatically.

c) On the Terminal Assembly press the RESET button alongside the LED that has come on to indicate the source of the shutdown.

d) This should reset both the shore and the ship sides of the MTL system, provided the inputs have been returned to their normal state and the shut-down was not caused by a fault in any part of the MTL901 system.

e) The need to press buttons in two separate places in sequence is deliberate to ensure some communication before restoring the system to an operational condition.

5 SYSTEM TESTING

The following procedures check the way in which the shore system and ship system each operate with their respective ESD circuits. They also check the functioning of the isolating devices contained within each assembly which enable the required signals to pass along the system.

The preparatory checks for the separate 'ends' of the system are the same whether or not the other end is equipped or whether a Pendant will need to be used. These are carried out prior to each transfer operation before the ship-to-shore link is in place and are detailed in the following two sections.

Where both ends are equipped and once the ship-to-shore link is in place, there is another procedure to check the link and to ensure compatibility between the two ends of the system.

In addition, there are other occasional system checks that need to be done at approximately three monthly intervals. They also need to be carried out after installation or after any major work has been carried out on the system. These are detailed in sections 5.6 to 5.8.

Neither the shore system nor the ship system has an on/off switch as they are normally left in a power-on situation. This prevents them being accidentally switched off during a transfer operation. However, an isolator will be needed in the power supply cable to facilitate maintenance work.

5.1 Routine testing of the shore system

During these test routines, it is recommended that both the jetty and the terminal assemblies are 'manned'. Although all the test procedures are conducted from the Jetty Assembly, correct operation is verified by observing the LEDs on the Terminal Assembly.

Note that in any position other than 'RUN', the keyswitch inhibits the shore ESD system from being triggered.

a) Turn the key switch on the Jetty Assembly (Figure 3) to 'TEST WITHOUT SHIP'. The two LEDs on the Jetty Assembly should come on. On the Terminal Assembly, the green LED and the yellow LED (indicating test/inhibit) should also come on.

b) Staying at the Jetty Assembly, press the red 'SHORE TEST' button. Both LEDs should go off. On the Terminal Assembly (Figure 2) the green LED should go off and the red 'ship initiated' LED should come on. This tests the isolating device in the Jetty Assembly in one direction.

c) Press the black 'RESET' button on the Jetty Assembly. Both LEDs on the Jetty Assembly should come on again. On the Terminal Assembly, the green LED should also come on while pressing the appropriate reset button should cause the adjacent red LED to go off.
Note: This is not essential during test routines.

d) Press the red 'SHIP TEST' button on the Jetty Assembly. Again both LEDs should go off indicating that the isolating device is also operating in the other direction. On the Terminal Assembly, the green LED should again go off. (If the red 'SHIP INITIATED ESD' LED was reset, then it will come on again. If not it will remain on.)

e) Press the 'RESET' button on the Jetty Assembly again to bring the LEDs back on. On the Terminal Assembly the green LED should come on and the appropriate reset button should be pressed so that the 'SHIP INITIATED ESD' red LED goes off.
Note that the system is also reset when the keyswitch on the Jetty Assembly is passed through the 'RESET' position.

5.2 Routine testing of the ship system

Note that in any other position than 'RUN', the keyswitch inhibits the ship ESD system from being triggered.

a) Turn the keyswitch on the Ship Assembly (Figure 4) to the 'TEST' position.

b) Connect the Pendant at (one of) the Junction Box(es) on deck whereupon the green LED on the Pendant and on the Ship Assembly should come on.

c) Operate in turn the 'STOP' button on the Pendant and the 'TEST' button on the Ship Assembly. In each case, both green LEDs should go off and the red LED on the Ship Assembly and on the Pendant should come on. Also the buzzer on the Pendant should sound.

d) After each test, reset the ship system by returning each button to its normal state.

5.3 Routine testing of the shore system with Pendant

Note that in any other position than 'RUN', the keyswitch inhibits the shore ESD system from being triggered.

a) Turn the keyswitch on the Jetty Assembly (Figure 3) to the 'TEST WITHOUT SHIP' position.

b) Connect the Pendant into the 'PENDANT LINK SOCKET' on the Jetty Assembly.

c) Turn the keyswitch on the Jetty Assembly to 'RESET' then through 'TEST WITHOUT SHIP' to 'TEST WITH SHIP' and back to 'TEST WITHOUT SHIP'. This resets the system for Pendant operation.

Note this sequence is required to ensure the two relay chains in the Jetty Assembly are de-energised, indicated by the two LEDs 'SHIP' and 'SHORE' on the Jetty Assembly being OFF. This state then mirrors the relays/LED when the keyswitch is in the 'RUN' position.

d) The green LED on the Pendant should be on together with the green LED on the Terminal Assembly. (The yellow LED on the Terminal Assembly should also be on indicating test procedures are being conducted and that the inhibit function is in operation.) If there are any apparent problems at this stage, check that the Pendant 'STOP' button is pushed in. (It has a pull to stop operation.)

e) Pull the Pendant 'STOP' button. On the Pendant, the green LED should go off, the red LED come on and the buzzer should sound. At the same time, on the Terminal Assembly the green LED will go out and the 'SHIP INITIATED ESD' LED should come on.

f) Return the Pendant 'STOP' button to its normal depressed position and, at the Terminal Assembly reset the 'SHIP INITIATED ESD' LED by pressing the appropriate button. Both green LEDs should again come on.

g) Return the keyswitch to the 'RUN' position. The Pendant is now armed for operation.

5.4 Routine testing with ship/shore link established

Once both systems have been checked independently, the compatibility of the two can be checked.

a) Remove any Pendant that may still be plugged in and plug the ship-to-shore link cable into the relevant sockets on the Jetty Assembly and on the (nearest) Junction Box on the ship. (The system will not operate with the ship-to-shore cable in place and with a Pendant plugged in.)

b) Turn the keyswitch on the Jetty Assembly to 'TEST WITH SHIP' and the keyswitch on the Ship Assembly to the test position. Operate the 'SHORE TEST' and 'SHIP TEST' buttons on the Jetty Assembly in turn resetting after each operation. If both LEDs on the Jetty Assembly go off on each occasion and come back on

once the system is reset, this demonstrates that the ship system and shore system are compatible. The LEDs on the terminal and ship assemblies should follow the patterns outlined earlier and on the Terminal Assembly will need to be reset at the appropriate times.

c) Turn both keyswitches to 'RUN' whereupon transfer can go ahead.

Note that if the routine compatibility test proves negative, transfer can go ahead as if one or other half of the system is non-equipped. The decision as to which part of the system to use will probably depend on whether the ship is loading or discharging.

5.5 Resetting the system after shutdown

a) Ensure that the ship and shore ESD systems have been reset.

b) Press the 'RESET' button on the Jetty Assembly. The green LEDs on the Jetty Assembly will come on and the red cluster LED on the Ship Assembly will then go off automatically.

c) On the Terminal Assembly press the 'RESET' button alongside the LED that has come on to indicate the source of the shutdown.

This should reset both the shore and the ship sides of the MTL system provided the inputs have been returned to their normal state and the shutdown was not caused by a fault in any part of the MTL system.

The need to press buttons in two separate places in sequence is deliberate to ensure some communication before restoring the system to an operational condition.

5.6 Comprehensive system checks

These should be conducted at approximately three month intervals and immediately after installation or major repairs. As some require items to be disconnected or electrical connections to be made, they should be undertaken by (or under the supervision of) a competent electrician.

5.7 Comprehensive checks – shore system

After conducting routine tests on the shore system first without and then with the Pendant, keep the system connected for Pendant operation with the keyswitch in the 'TEST WITHOUT SHIP' position.

The additional tests rely on operating the shore ESD system. If possible, this should be carried out with the ESD relay input contact to the MTL system operational but with the full shut-down facilities inhibited. The output from the MTL system to the shore ESD system is inhibited during these tests.

a) Operate the shore ESD system. This should cause the green LED on the Terminal Assembly to go off and to turn on the red LED indicating 'shore initiated ESD'.

b) Return the shore ESD system to its normal state. This automatically resets the MTL 901 system.

c) Reset the 'shore initiated ESD' on the Terminal Assembly by pressing the appropriate button.

These tests check everything except for the ship-to-shore link cable and the physical link between the output trip relay MTL 5314 (Unit 7) and terminals 6 and 8 in the Terminal Assembly. The cable can be checked as detailed in section 6.1 on 'Cable faults'. The output relay can be checked as follows:-

d) With the keyswitch on the Jetty Assembly set to the 'TEST WITHOUT SHIP' position, disconnect the shore ESD system, connect a multimeter/ohmmeter to terminals 6 and 8 and short out terminals 11 and 12. The meter should indicate that the contacts at terminals 6 and 8 are closed.

e) With the shore system connected for Pendant operation turn the keyswitch on the Jetty Assembly to 'RUN'.

f) Pull the 'STOP' button on the Pendant. This should operate the MTL5314 (Unit 7) and cause the meter to indicate that the contacts have opened.

Note that the test with the Pendant ideally requires two people. Those concerned should arrange to be in sight or sound of each other with some pre-arranged signalling system.

5.8 Comprehensive checks – ship system

These tests require the operation of the ship ESD system. If possible, they should be conducted with the ESD relay input contact to the MTL system operational but with full shut down facilities inhibited. The output from the MTL system to the ship ESD system is NOT inhibited during these tests. If the full shutdown facilities cannot be inhibited, or, if the ship ESD system cannot be operated during the following test procedures, then steps c) to e) outlined below should be carried out with the link between terminals 10 and 11 opened to simulate a ship initiated ESD, which is preferable to using the Pendant.

a) With the Pendant unit connected and the keyswitch in the 'RUN' position, operate the ship ESD system. On the Pendant unit, this should turn off the green LED and turn on the red LED and the buzzer. On the Ship Assembly, this should turn off the green LED and turn on the red 'emergency shutdown' LED.

b) Return the ship ESD system to its normal state. This should turn off the red LEDs and the buzzer and turn on the green LEDs

These tests check everything except for the physical link between the output trip relay MTL5314 (Unit 7) and terminals 6 and 8. If this link is doubted in any way, it can be checked as follows:-

c) With the keyswitch on the Ship Assembly set to the 'TEST' position, disconnect the ship ESD system, connect a multimeter/ ohmmeter to terminals 6 and 8 and short out terminals 10 and 11. The meter should indicate that the contacts at terminals 6 and 8 are closed.

d) With the system connected for Pendant operation turn the keyswitch to 'RUN'.

e) Pull the 'STOP' button on the Pendant. This should operate the MTL5314 (Unit 7) and cause the meter to indicate that the contacts have opened.

5.9 Checking trip amplifier set point

The operation of the ship/shore system relies upon the correct setting of the trip amplifier set points of the MTL5314 units in both the terminal and ship assemblies. The set points are conFigured before delivery and therefore should not need to be altered, but, if there is any reason to doubt them, they can be reset by using the procedures described in this section.

Note that the unit numbers mentioned are given on drawings in Figures 6 and 9.

These tests require the operation of the ship and shore ESD systems. If possible, they should be conducted with the ESD relay input contacts to the MTL system operational but with full shut down facilities inhibited. The output from the MTL system to the ship and shore ESD systems is inhibited during these tests.

Alternatively, the ship and shore ESD systems can be disconnected and the input contacts at terminals 10, 11 and 12 in the Terminal Assembly and 10 and 11 in the Ship Assembly 'shorted' and 'opened' to check the following procedures.

5.9.1 Terminal Assembly (see Figure 6)

The following procedure is best carried out with the Terminal and Jetty Assemblies situated close to one another because the 'RESET' button on the Jetty Assembly needs to be held down while the set-point adjustment screw on top of Unit 7 is rotated.

i) Connect the shore system (without the Pendant unit).

ii) The LED on MTL5024 (Unit 5) should be on.

iii) Set the keyswitch on the Jetty Assembly to the 'TEST WITHOUT SHIP' position.

iv) The LEDs on Units 6 and 8 should now be on.

v) Ensure that the LED on top of the trip amplifier MTL5314 (Unit 7), if OFF. If this LED is ON then adjust the trip amplifier set-point via the two trimming potentiometers on top of this unit. To set the correct set-point the following procedure should be followed.

Unplug the blue coloured connector on the top of the MTL5314 (Unit 7) and insert a test plug with two leads (terminals 1 & 3) to enable a current source to be connected. This current source should be capable of providing 0 – 20mA (Note. Care should be taken to restrict the current to less than 30mA in order not to damage the safety components of the MTL5314 (Unit 7)). Set the current source to 4.0mA and connect to it the test leads, observing the correct polarity.

Press the "RESET" pushbutton on the Jetty Assembly and while holding it down adjust the two trimming potentiometers with a small screwdriver until the two LEDs A and B on the MTL5314 (Unit 7) just turn OFF. Release the 'RESET' button. The unit is now calibrated.

Remove the test plug and leads and refit the blue connector.

vi) To check the set point, press the 'RESET' button on the jetty assembly again and, while holding it down, operate the shore ESD system. Check that the LEDs on Units 4 and 6 come on.

vii) Reset the shore ESD system, the LEDs on Units 4 and 6 should be extinguished.

viii) For a thorough check, connect the Pendant unit and repeat the test procedures detailed in section 5.3 to check that the system is operating correctly.

5.9.2 Ship Assembly (see Figure 9)

Connect up the system with the Pendant unit included. The position of the keyswitch is not important. Then carry out the following procedure:–

i) The LED on MTL5024 (Unit 5) should be on.

ii) Ensure that the LED on top of the trip amplifier MTL5314 (Unit 4) if OFF. If it is ON, then adjust the trip amplifier set point using the two trimming potentiometers on top of this unit. To adjust to the correct set point, follow procedures iii, iv and v below.

iii) Unplug the blue coloured connector on the top of the MTL5314 (Unit 4) and insert a test plug with two leads (terminals 1 & 3) to enable a current source to be connected. This current source should be capable of providing 0 – 20mA (Note. Care should be taken to restrict the current to less than 30mA in order not to damage the safety components of the MTL5314 (Unit 7)). Set the current source to 4.0mA and connect to it the test leads, observing the correct polarity.

iv) Adjust the two trimming potentiometers until the two LEDs A and B on the MTL5314 just turn OFF. The unit is now calibrated.

v) Remove the test plug and leads and refit the blue connector.

vi) To check the set point, operate the ship ESD system. Check that the LED on Unit 5 is extinguished and that the LEDs on Units 3 and 4 come on.

vi) Reset the ship ESD system, the LED on Unit 5 should come on and the LEDs on Units 3 and 4 be extinguished.

vii) For a thorough check, set the keyswitch to the 'RUN' position and operate the pushbutton on the emergency stop Pendant unit. The red LED on the Ship Assembly should come on, the green LED should be extinguished and the red LED and buzzer on the Pendant unit should turn on.

6. DETAILED FAULT FINDING PROCEDURES

6.1 Cable faults

If a fault in the ship/shore cable is suspected, this can be checked by disconnecting the ship end of the cable and turning the key switch on the Jetty Assembly to the 'TEST WITHOUT SHIP' position. Press the 'RESET' button to light the LEDs, then short circuit pins 1 and 2 on the free end of the cable. If the LEDs go out, the cable is OK; if not it is faulty. If a fault in the Pendant link cable or juntion box is suspected, these should be tested for continuity using an appropriate meter. If the layout of the facility is such that cable damage is likely to be frequent, it may be wise to hold another cable in store.

6.2 Circuit faults: complete ship-to-shore system

A functional schematic diagram of the ship-to-shore system is shown in Figure 13.

This system is basically an IS link connecting the ship and shore ESD systems.

The shore/jetty and ship/jetty current loops are isolated by the RLU328 relay.

Volt free contact inputs from ship and shore ESDs are closed in normal operation and a current (approximately 7mA) flows in both shore/jetty and ship/jetty loops. Relay outputs to both systems are now closed.

If the current in either loop is interrupted either by removing the short from the input of the MTL5024 (Unit 5), or by pressing the emergency stop button on a hand held Pendant (not shown on the diagram), both trip amplifiers trip and the shore/jetty and ship/jetty relays outputs open to produce an alarm condition.

The correct operational status of the relevant indicators, and corresponding values of current and voltages are shown in Table 1.

Suspected fault conditions can be checked against the table and circuit diagram

Sections 6.3 and 6.4 contain similar information for part systems described in section 2.3 where the Pendant replaces either the shore or the ship part of the ESD link.

6.3 Circuit faults: ship system with Pendant

A functional schematic diagram of the ship system with Pendant is show in Figure 14.

The correct operational status of the relevant indicators (LEDs, buzzer etc) and corresponding values of current and voltages are shown in Table 2.

Suspected fault conditions can be checked against this table and the circuit diagrams.

If a Pendant fault is suspected and the cable itself has been checked the following simple tests can be made on the Pendant.

a) Connect a 9 volt battery across pins D (+ve) and E (–ve) of the Pendant plug. This should activate the sounder and illuminate the RED LED. Measured current should be approximately 6mA.

b) Connect a 9 volt battery across pins B (+ve) and C (–ve). The GREEN LED should illuminate when the 'STOP' button is IN (i.e. in the RUN position). The measured current should be approximately 50mA.

6.3.1 Pendant checks from Ship Assembly SIG 06

These are alternatives to the Pendant checks detailed in table 1:–

At Unit 5, shorting connections 1 and 8 will extinguish the GREEN LED and turn on the RED LED on both the Ship Assembly and the Pendant, and sound the buzzer. LEDs on Units 3 and 4 in the Ship Assembly will also come on.

At Unit 3, shorting connections 10 and 13 will bring on the LED at that unit and sound the Pendant buzzer. The GREEN LEDs on both the Pendant and the Ship Assembly will remain on.

6.4 Circuit faults: shore system with Pendant

A functional schematic diagram of the shore system with Pendant is shown in Figure 15.

The correct operational status of the relevant indicators (LEDs, buzzer etc) and corresponding values of current and voltages are shown in Table 3.

Suspected fault conditions can be checked against this table and the circuit diagrams.

If a Pendant fault is suspected and the cable itself has been checked the following simple tests can be made on the Pendant.

a) Connect a 9 volt battery across pins D (+ve) and E (–ve) of the Pendant plug. This should activate the sounder and illuminate the red LED. The current supplied should be approximately 6mA.

b) Connect a 9 volt battery across pins B (+ve) and C (–ve) of the Pendant plug. The green LED should illuminate when the 'STOP' button is IN (i.e. in the RUN position). The current supplied should be approximately 50mA.

6.4.1 Pendant checks from Terminal Assembly SIG 01

These are alternatives to the Pendant checks detailed in table 1:–

Shorting the output connections 1 and 2 on Unit 6 will extinguish the green LED and turn on the red LED on both the Ship Assembly and the Pendant, and sound the buzzer. LEDs on Units 5 and 7 in the Terminal Assembly will also come on.

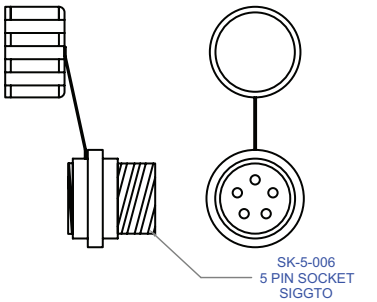
Shorting the input connections 11 and 12 on Unit 5 will light the LED on that unit and sound the Pendant buzzer. The green LEDs on the Pendant and the Terminal Assembly will remain on.

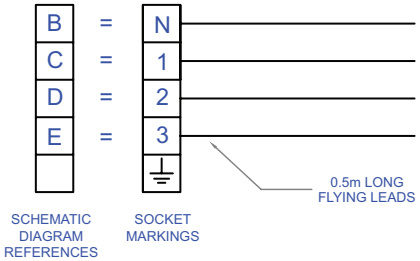
The red LED on the Terminal Assembly that indicates 'SHIP INITIATED SHUT DOWN' will illuminate.

7. SIG12 MODIFICATION KIT

From February 2011 onwards, all new SIG03 and SIG08 Pendants are fitted with a 5-pin plug to replace the (now obsolete) 6-pin version fitted to earlier models; consequently, to connect a new SIG03 or SIG08 to older equipment requires the old 6-pin socket to be replaced with a new 5-pin one.

A SIG12 modification kit has been prepared - consisting of a socket fitted with flying leads - to enable a user to carry out an onsite replacement. The following instructions describe how to replace the old socket using the parts supplied in the modification kit.





7.1 Replacement instructions

7.1.1 Removing old 6-pin socket

First remove the 6-pin socket by disconnecting the internal wiring from the individual screw terminals and then removing the four M5 bolts securing the socket to its enclosure; the socket can then be pulled free.

7.1.2 Fitting new 5-pin socket

1. Identify the socket and the socket cap from the parts supplied in the kit.
2. Take hold of the socket and feed the 0.5 metre flying leads through the existing hole in the enclosure.
3. Fit **three** of the new M5 bolts, washers and nuts supplied, but do not tighten them.
4. Attach the socket-cap retaining cord with the final M5 bolt and fit its washer and nut.
5. Tighten all four fixing bolts ensuring a good seal to the enclosure with the supplied washer.

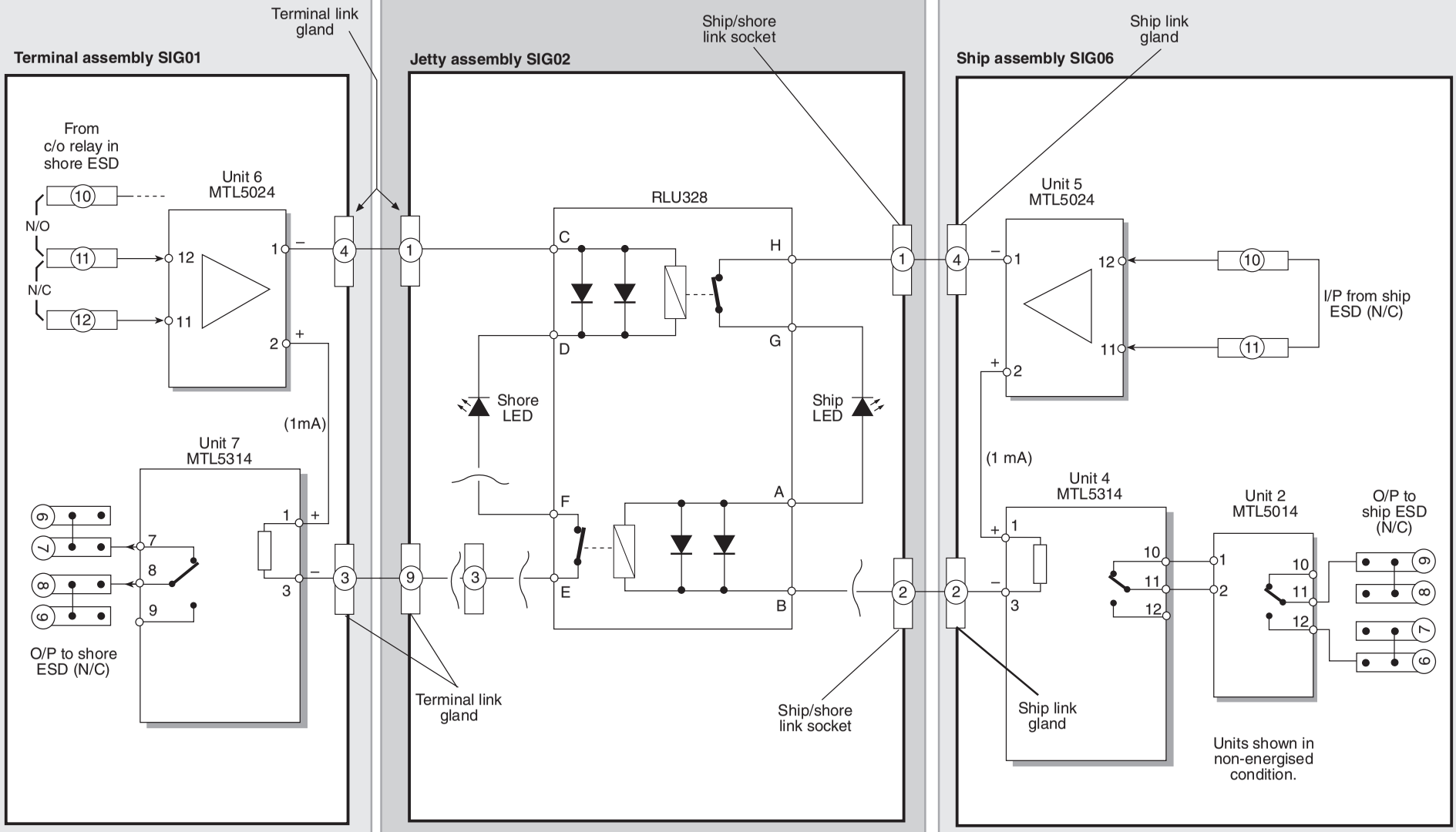
7.1.2 Wiring 5-pin socket

The socket wiring depends upon the unit to which the new socket is being fitted.

Select suitable crimp ferrules for the wires and follow the wiring diagrams shown in Figure 16 (SIG02), Figure 17 (SIG10) and Figure 18 (SIG11).

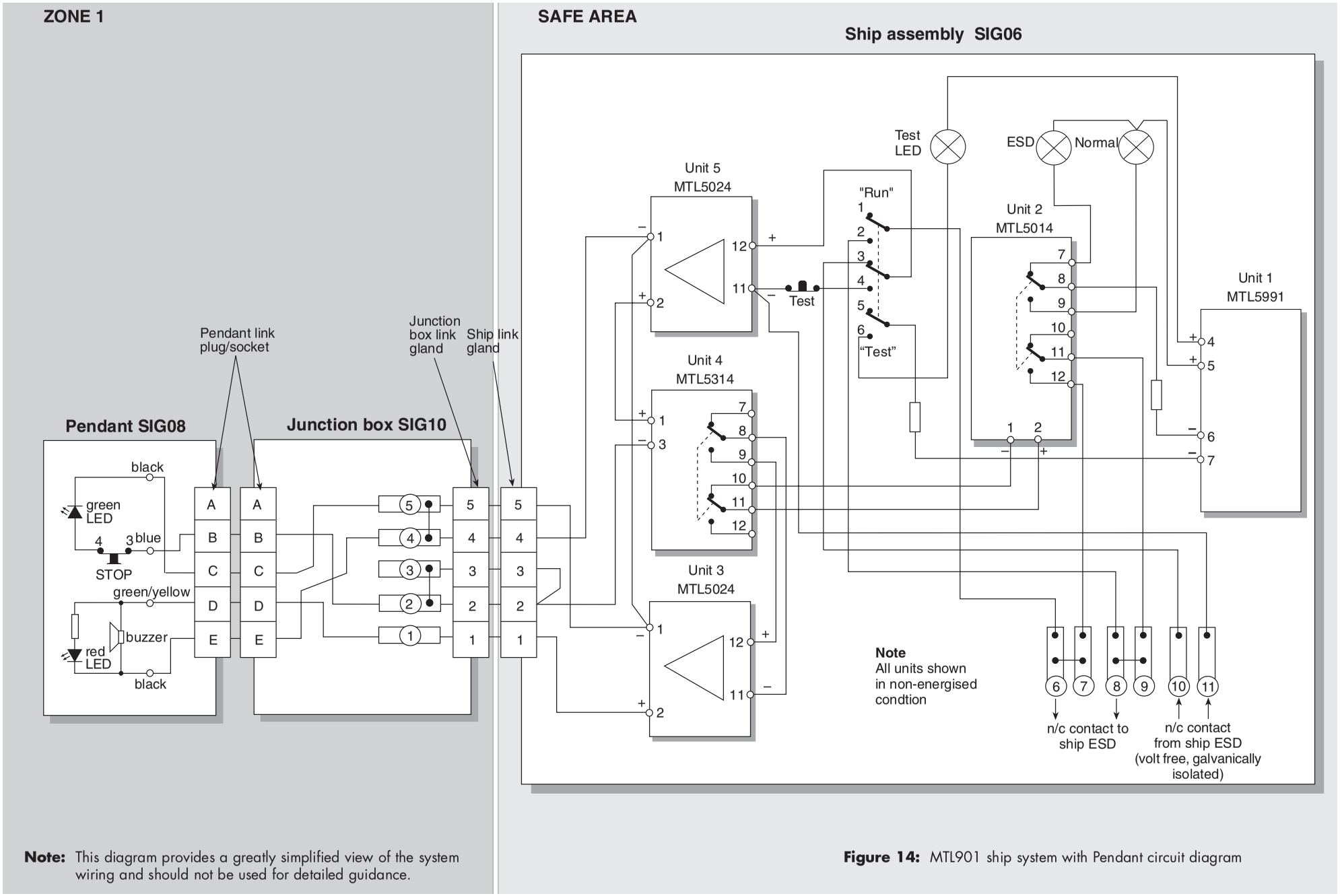
On completion of the wiring, and detailed visual inspection, carry out continuity checks between the socket and the screw terminals.

Finally, carry out a full test of the system as per the test procedures in this manual.



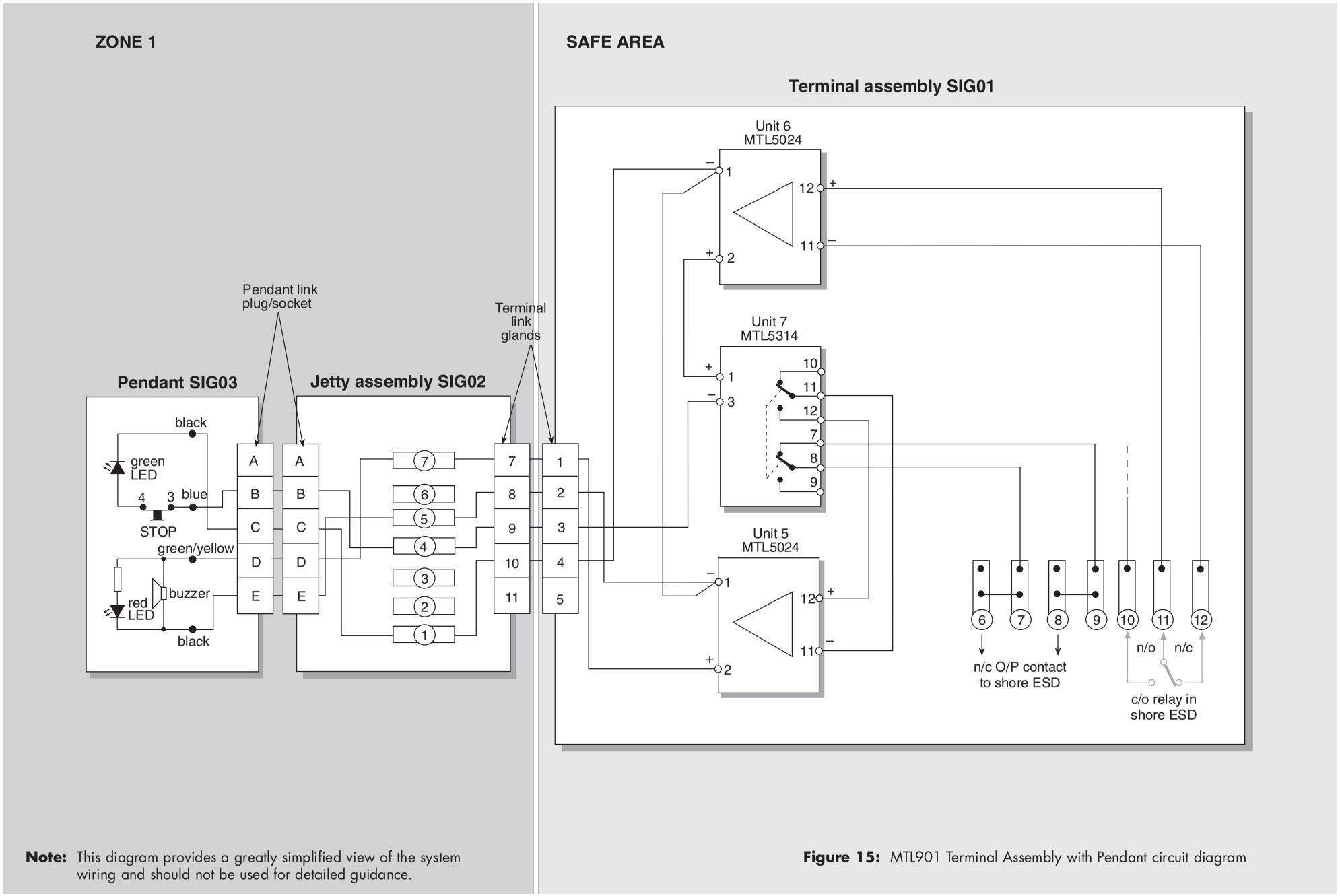
Note: This diagram provides a greatly simplified view of the system wiring and should not be used for detailed guidance.

Figure 13: MTL901 ship-to-shore circuit concept of complete system



Note: This diagram provides a greatly simplified view of the system wiring and should not be used for detailed guidance.

Figure 14: MTL901 ship system with Pendant circuit diagram



Note: This diagram provides a greatly simplified view of the system wiring and should not be used for detailed guidance.

Figure 15: MTL901 Terminal Assembly with Pendant circuit diagram

ZONE 1

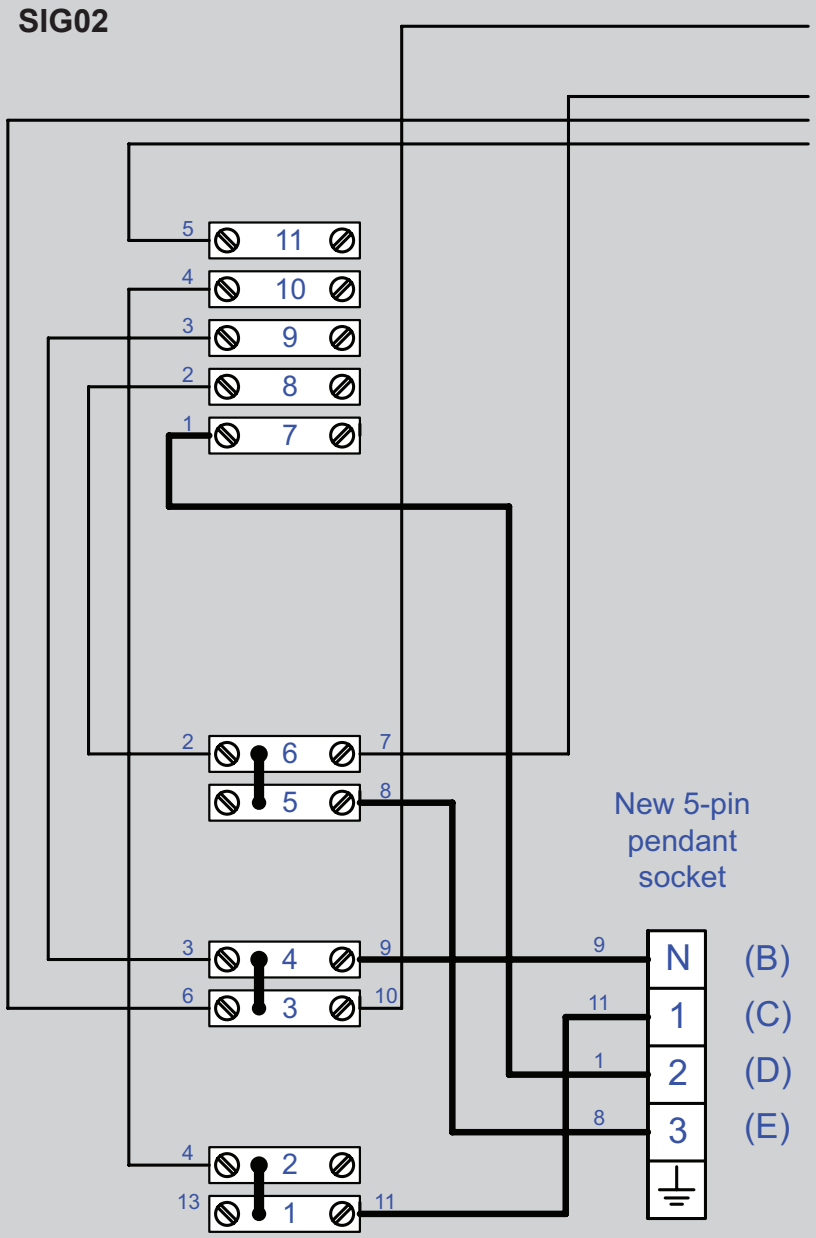


Figure 16: Wiring new 5-pin socket into SIG02 enclosure
(Partial wiring diagram showing affected wiring)

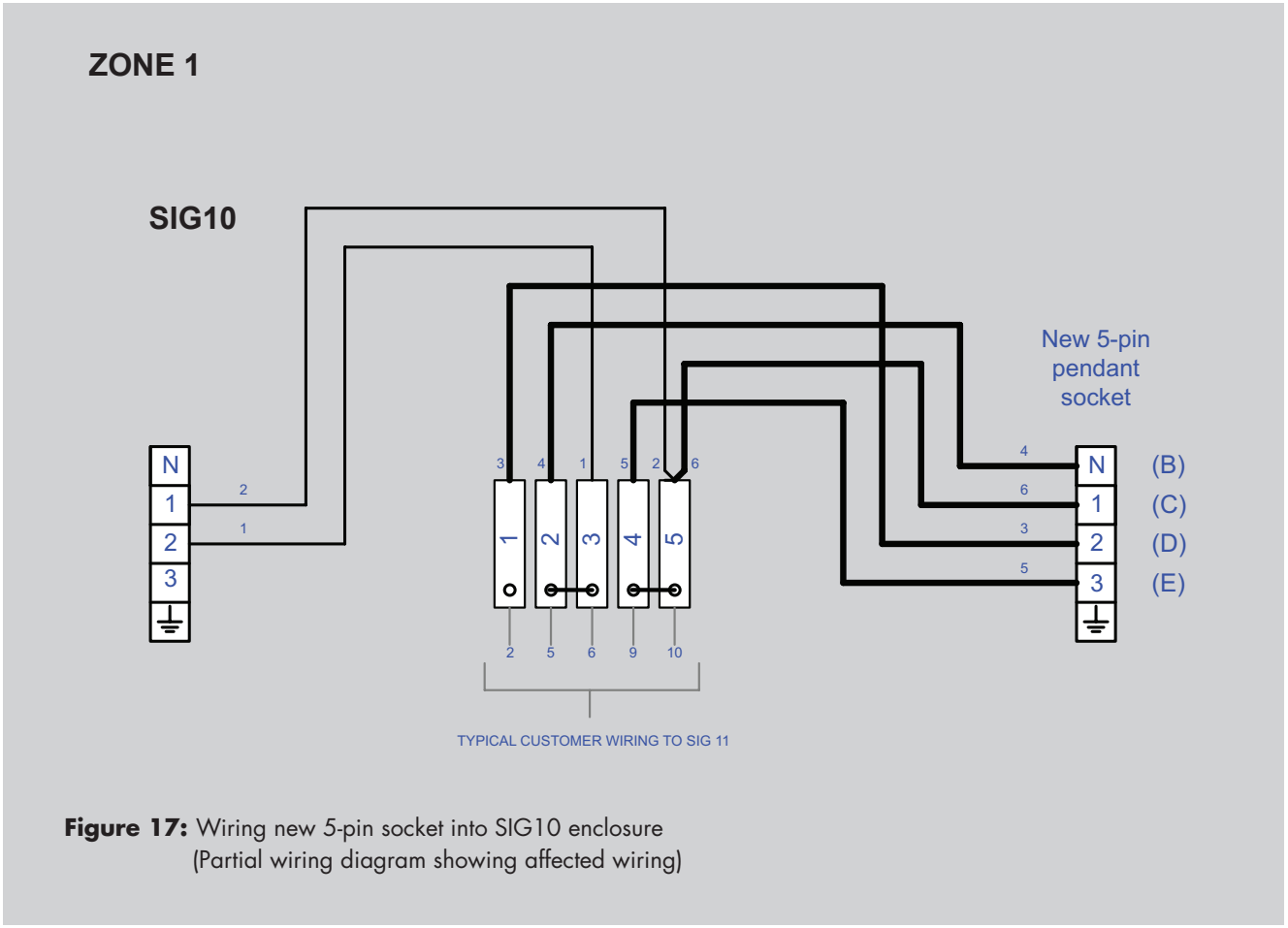


Figure 17: Wiring new 5-pin socket into SIG10 enclosure
(Partial wiring diagram showing affected wiring)

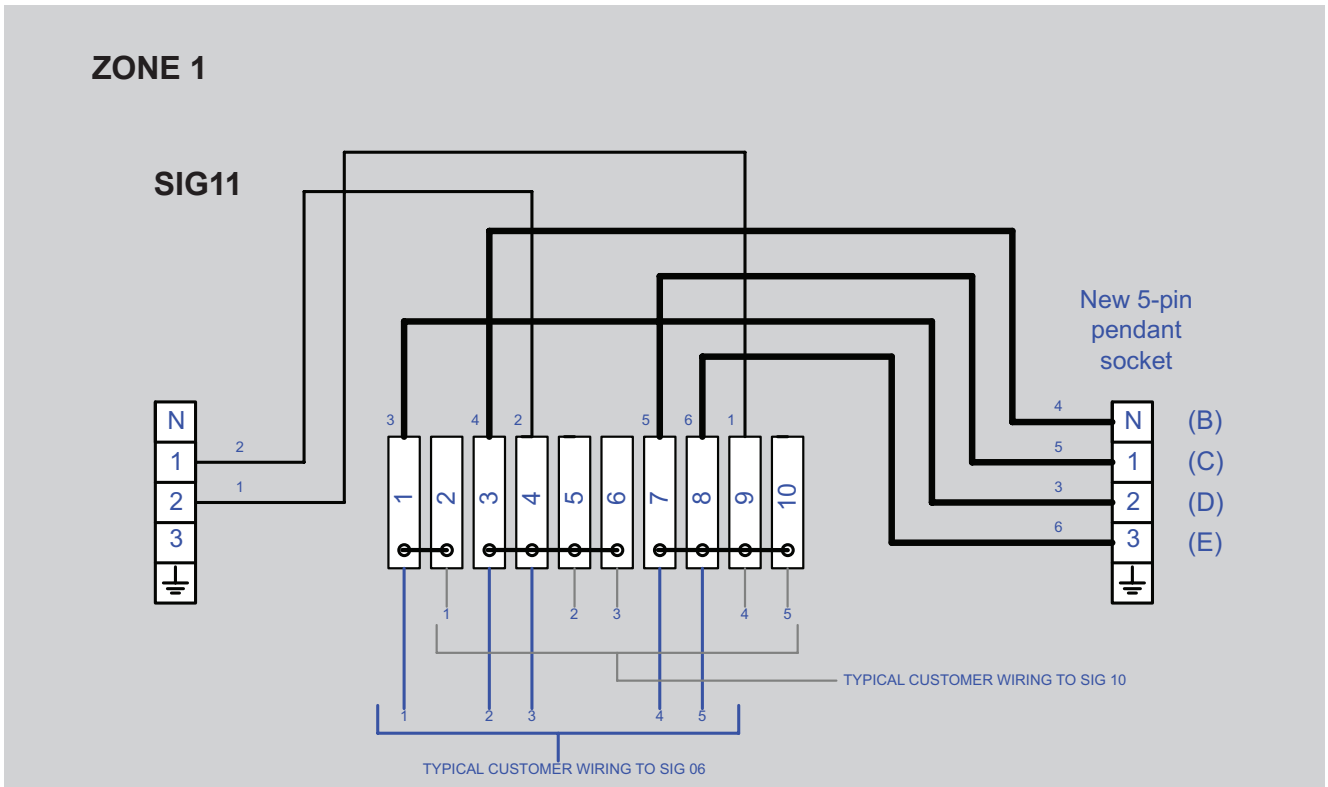


Figure 18: Wiring new 5-pin socket into SIG11enclosure
(Partial wiring diagram showing affected wiring)

TABLE 1 COMPLETE Ship-to-shore SYSTEM: OPERATIONAL STATUS INDICATORS

	GREEN LED		RED LED		BUZZER		PENDANT STOP P/B		RELEVANT PARAMETERS				COMMENTS
EQUIPMENT	**NORMAL**	**ESD**	**NORMAL**	**ESD**	**NORMAL**	**ESD**	**NORMAL**	**ESD**	**I_{NORMAL}**	**I_{ESD}**	**V_{NORMAL}**	**V_{ESD}**	
SHIP ASSY SIG06													
LID	ON	OFF	OFF	ON	N/A	N/A	N/A	N/A					
UNIT 2 (MTL5014)	N/A	N/A	ON	OFF	N/A	N/A	N/A	N/A					
UNIT 3 (MTL5024)	N/A	N/A	OFF	ON	N/A	N/A	N/A	N/A	–			V_{1-7} = 22.5V	
UNIT 4 (MTL5314)	N/A	N/A	OFF	ON	N/A	N/A	N/A	N/A					
UNIT 5 (MTL5024)	N/A	N/A	ON	OFF	N/A	N/A	N/A	N/A	5mA	–	V_{1-7} = 21.3V	V_{1-7} = 22.5V	
JETTY ASSY SIG02													
LID	ON	OFF	N/A	N/A	N/A	N/A	N/A	N/A					
	ON	OFF	N/A	N/A	N/A	N/A	N/A	N/A					
RLU328	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	7mA		V_{T1-T3} = 19.29V	V_{T1-T3} = 20.9V	
TERMINAL ASSY SIG 01													
LID	ON	OFF	OFF	ON*	N/A	N/A	N/A	N/A					
UNIT 5 (MTL5024)	N/A	N/A	OFF	ON	N/A	N/A	N/A	N/A				V_{1-8} = 22.6V	
UNIT 6 (MTL5024)	N/A	N/A	ON	OFF	N/A	N/A	N/A	N/A	7mA	0	V_{1-8} = 21.3V	V_{1-8} = 22.5V	
UNIT 7 (MTL5314)	N/A	N/A	OFF	ON	N/A	N/A	N/A	N/A					

N/A = Not Applicable to the equipment concerned * Ship initiated or shore initiated LED as appropriate

TABLE 2 SHIP SYSTEM WITH PENDANT: OPERATIONAL STATUS INDICATORS

	GREEN LED		RED LED		BUZZER		PENDANT STOP P/B		RELEVANT PARAMETERS(*)				COMMENTS
EQUIPMENT	**NORMAL**	**ESD**	**NORMAL**	**ESD**	**NORMAL**	**ESD**	**NORMAL**	**ESD**	**I_{NORMAL}**	**I_{ESD}**	**V_{NORMAL}**	**V_{ESD}**	
SHIP ASSY SIG06													
LID	ON	OFF	OFF	ON	N/A	N/A	N/A	N/A					
UNIT 2 (MTL5014)	N/A	N/A	ON	OFF	N/A	N/A	N/A	N/A					
UNIT 3 (MTL5024)	N/A	N/A	OFF	ON	N/A	N/A	N/A	N/A		21mA		V_{1-7} = 18.7V	
UNIT 4 (MTL5314)	N/A	N/A	OFF	ON	N/A	N/A	N/A	N/A					
UNIT 5 (MTL5024)	N/A	N/A	ON	OFF	N/A	N/A	N/A	N/A	45mA	–	V_{1-7} = 14.3V	V_{1-7} = 22.6V	
PENDANT SIG08	ON	OFF	OFF	ON	OFF	SOUNDS	IN	OUT	12mA		13.3V	22.5V	I&V for Pendant green LED measured at terminals 2&5 in either SIG06 (Ship Assy) or SIG10 (Junction Box)
										21mA		18.7V	I&V for Buzzer measured at terminals 1&4 in either SIG06 (Ship Assy) or SIG10 (Junction Box)

N/A = Not Applicable to the equipment concerned (*) = Values for ESD relate to initiation from Pendant stop pushbutton

TABLE 3 SHORE SYSTEM WITH PENDANT: OPERATIONAL STATUS INDICATOR

	GREEN LED		RED LED		BUZZER		PENDANT STOP P/B		RELEVANT PARAMETERS(*)				COMMENTS
EQUIPMENT	**NORMAL**	**ESD**	**NORMAL**	**ESD**	**NORMAL**	**ESD**	**NORMAL**	**ESD**	**I_{NORMAL}**	**I_{ESD}**	**V_{NORMAL}**	**V_{ESD}**	
SHIP ASSY SIG01													
LID	ON	OFF	OFF	ON†	N/A	N/A	N/A	N/A					
UNIT 5 (MTL5024)	N/A	N/A	OFF	ON	N/A	N/A	N/A	N/A		21mA		V_{1-7} = 22.7V	
UNIT 6 (MTL5024)	N/A	N/A	ON	OFF	N/A	N/A	N/A	N/A	43mA	21mA	V_{1-7} = 14.3V	V_{1-7} = 22.7V	
UNIT 7 (MTL5314)	N/A	N/A	OFF	ON	N/A	N/A	N/A	N/A					
PENDANT SIG03	ON	OFF	OFF	ON	OFF	SOUNDS	IN	OUT	43mA		13.2V	22.6V	I&V for Pendant green LED measured at terminals 3&4 in either SIG01 terminal assy or terminals 1&4 in jetty assy SIG02
										20mA		18.8V	I&V for Buzzer measured at terminals 5&7 in either jetty assy SIG02 or terminal 1&2 in terminal assy SIG01
JETTY ASSY SIG02													
LID	ON	OFF	N/A	N/A			N/A	N/A					SEE PENDANT ABOVE
	ON	OFF	N/A	N/A			N/A	N/A					

N/A = Not Applicable to the equipment concerned (*) = Values for ESD relate to initiation from Pendant stop pushbutton
† = As appropriate depending on Pendant (ship) or shore initiated ESD

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