

**Handheld
Installation Manual
MM12822 Rev. L 7/02**

Table of Contents

Handheld.....	1
MM12822 Rev. L 7/02	
Table of Contents	3
MM12822 Revisions List	6
1.0 THIS MANUAL - - - - -	7
2.0 THEORY OF OPERATION - - - - -	7
2.1 Features	7
Table 1: Handheld Systems.....	8
2.2 Typical Cabling	8
Figure 1: Pluggable Handheld Typical Cabling Diagram	9
Figure 2: Plug'n'Play Typical Cabling Diagram	9
Figure 3: Side View of Receptacle and Cable	10
2.3 Safety Lanyard	10
Figure 4: Safety Lanyard	10
Figure 5: Locking Key	11
Figure 6: Control Knobs Vertical	11
2.4 Engine Stop Switch.....	11
Figure 7: Engine Stop Switch	11
2.5 Thruster Command (Optional)	11
Figure 8: Thruster Switches	11
3.0 OPERATOR INSTRUCTIONS - - - - -	12
3.1 Single or Twin Screw Command	12
Figure 9: Station Transfer	12
Figure 10: Taking Command at the Handheld	12
Figure 11: Optional Bracket Mounting	13
3.2 Moving from One Receptacle location to Another.....	13
Figure 12: Receptacle Protective Cap	13
3.3 Thruster Control (Optional)	13
Figure 13: Bow & Stern Thruster Switches	14
4.0 REQUIRED PARTS AND TOOLS - - - - -	15
4.1 Electric Cable	15
4.2 Tools Required For Installation	15
4.3 Handheld Remote Control.....	15
5.0 PLAN THE INSTALLATION - - - - -	16
5.1 Receptacle Location	16
Figure 14: Receptacle Mounting Location	16
Figure 15: Receptacle Protector Assembly	16
5.2 Handheld Location	16
Figure 16: Handheld Dimensions	16
5.3 Relay Junction Box Location	16
Figure 17: Relay Junction Box Dimensions	17
5.4 Engine Stop Switch.....	17
5.5 DC Input Power.....	17
6.0 INSTALLATION - - - - -	18
6.1 Relay Junction Box.....	18
Figure 18: Relay Junction Box Parts	18
6.2 Receptacle	18

Figure 19: Receptacle Bulkhead Mounting	18
Figure 20: Receptacle Cable Strain Relief	19
6.2.1 Receptacle Protector with Hardwired Receptacles (Optional)	20
6.2.2 Receptacle Protector with Plug'n'Play Receptacles (Optional)	20
Figure 21: Receptacle Protector Dimensions	20
6.3 Receptacle Cable to Relay Junction Box	20
Figure 22: Junction Box Receptacle Cable Wiring Diagram	21
6.4 Power Cable Installation	21
Figure 23: Junction Box Power Cable Wiring Diagram	21
6.5 Engine Stop Cable Installation	22
Figure 24: Junction Box Engine Stop Cable Wiring Diagram	22
6.6 Thruster Cable Installation (Optional)	23
6.6.1 Thruster Cable Connection at Junction Box	23
Figure 25: Junction Box Thruster Cable Wiring Diagram	23
6.6.2 Thruster Cable Connections at the Thruster	23
6.7 Receptacle Cable Installation to Actuator/Processor	24
6.7.1 Port and Starboard Hardwire Receptacle Connection	24
Figure 27: Actuator/Processor Watertight Cable Grip Installation	24
Figure 26: Typical Connections at Thruster	24
6.7.2 Port and Starboard Plug'n'Play Connection	25
Figure 28: WAGO Tool	25
Figure 29: Typical Connections at Actuator/Processor	25
7.0 ADJUSTMENTS AND TESTS (SECURED TO DOCK)	26
7.1 Handheld Unit (Engines Stopped)	26
7.2 Engine Stop Switches Test (Engines Running)	26
7.3 Optional Thruster Switch Test (Engines Running)	27
8.0 ADJUSTMENTS AND TESTS (UNDERWAY)	28
9.0 MAINTENANCE	29
9.1 Handheld Unit and Relay Junction Box	29
10.0 PARTS SOURCE	30
Table 2: Parts List	30
MMC-288 Rev.C 7/01	33

References

Appendix A.1

1.0 TROUBLESHOOTING	1
1.1 Questions to ask before beginning troubleshooting	1
1.2 Inspection of System	3
1.3 Taking Command	3
1.4 Command Signal Testing	4
1.5 Station Select Testing	4
1.6 List of Possible Symptoms and Solutions	4
1.7 Station Connection Cable Pin-Out (Plug'n'Play Only)	5
Figure 1: Control Head Harness Pin Out	5

Appendix B.1

Drawing 11442B No Thrusters - Single Screw [PN: 1213-1]	1
Drawing 11901 No Thrusters - Single Screw [PN: 1213-1P, -2P, -3P]	3
Drawing 11439B No Thrusters - Twin Screw [PN: 1214-1, -2, -3]	5

Drawing 11898 No Thrusters - Twin Screw [PN: 1214-1P, -2P, -3P]	7
Drawing 11441B One Thruster - Single Screw [PN: 1443-1, -2, -3]	9
Drawing 11900 One Thruster - Single Screw [PN: 1443-1P, -2P, -3P]	11
Drawing 11438B One Thruster - Twin Screw [PN: 1251-1, -2, -3]	13
Drawing 11852A One Thruster - Twin Screw [PN: 1251-1P, -2P, -3P]	15
Drawing 11440B Bow/Stern Thrusters - Single Screw [PN: 1444-1, -2, -3]	17
Drawing 11899 Bow/Stern Thrusters - Single Screw [PN: 1444-1P, -2P, -3P]	19
Drawing 11437B Bow/Stern Thrusters - Twin Screw [PN: 1492-1, -2, -3]	21
Drawing 11896 Bow/Stern Thrusters - Twin Screw [PN: 1492-1P, -2P, -3P]	23

MM12822 Revisions List

Rev	Date	Revision Description
A - I		Previous Revision were not documented
J	1/02	<ol style="list-style-type: none">1. Added Revisions List2. Rewrote complete manual. Review complete manual.3. Added Troubleshooting Section under Appendix A.1 and moved drawings to Appendix B.14. Drawing in Appendix B.1 revised to A.
K	3/02	Adding information on the Plug'n Play Handheld. Review complete manual for all additions and changes.
L	7/02	Revised Figure 3 Receptacle and Cable for Plug'n'Play Artwork 11913 to A per ELR 781.

1.0 THIS MANUAL

The purpose of the Handheld manual is:

- Operation (Section 3.0)
- Installation (Section 6.0)
- Troubleshooting (Appendix A.1)

Keep this Manual on the vessel for future reference.

Throughout this manual special attention should be paid to the following:

NOTE: Contains Helpful Information

CAUTION: Damage to equipment could occur if this message is disregarded.

WARNING: Personal Injury could occur if this message is disregarded.

2.0 THEORY OF OPERATION

The Handheld Remote Control System (hereafter referred to as Handheld System) is offered as an accessory for MicroCommander, ClearCommand, or CruiseCommand Propulsion Control Systems (hereafter referred to as Actuator/Processor).

The Handheld System is utilized as a secondary Station, while the primary Station is generally a fixed Bridge Station.

2.1 FEATURES

Handheld Systems offers:

- Command of the vessel's main engine speed and direction
- Engine speed limited to approximately **80%**
- Station-in-Command indication (LED)
- Push button station transfer
- Main engine emergency shutdown (Engine Stop Switch)
- Safety Lanyard

Optional:

- Thruster Control
- Stainless steel mounting bracket

- Cable Extension – 25 feet (7,62m)
- Additional Receptacles
- Receptacle Protector
- Additional Handheld Units
- Additional Safety Lanyards

ZF Mathers, LLC. offers several different configurations of Handheld Systems. Refer to Table 1: for a list of Handheld System configurations. Refer to Appendix B.1 Drawings for Installation Drawings.

Table 1: Handheld Systems

ZF Mathers Part Number					
Handheld Systems	Single Screw	Single Screw Plug'n Play	Twin Screw	Twin Screw Plug'n Play	Cable Length in Feet
Main Engine Control Only	1213-1	1213-1P	1214-1	1214-1P	50 feet (15,24m)
	1213-2	1213-2P	1214-2	1214-2P	100 feet (30,48m)
	1213-3	1213-3P	1214-3	1214-3P	150 feet (45,72m)
Main Engine Control and One Thruster Control	1443-1	1443-1P	1251-1	1251-1P	50 feet (15,24m)
	1443-2	1443-2P	1251-2	1251-2P	100 feet (30,48m)
	1443-3	1443-3P	1251-3	1251-3P	150 feet (45,72m)
Main Engine Control and Two Thruster Control	1444-1	1444-1P	1492-1	1492-1P	50 feet (15,24m)
	1444-2	1444-2P	1492-2	1492-2P	100 feet (30,48m)
	1444-3	1444-3P	1492-3	1492-3P	150 feet (45,72m)

2.2 TYPICAL CABLING

Refer to Figure 1: for a typical cabling diagram of a Pluggable Handheld System. This diagram demonstrates all connection options for the different variety of Pluggable Handheld Systems available.

Refer to Figure 2: for a typical cabling diagram of a Plug'n'Play Handheld System. This diagram demonstrates all connection options for the different variety of Plug'n'Play Handheld Systems available.

Refer to Appendix B-1 Drawings:

- for the Handheld System being used with this vessel
- connections to the Handheld System
- connections to the Actuator/Processors.

THEORY OF OPERATION

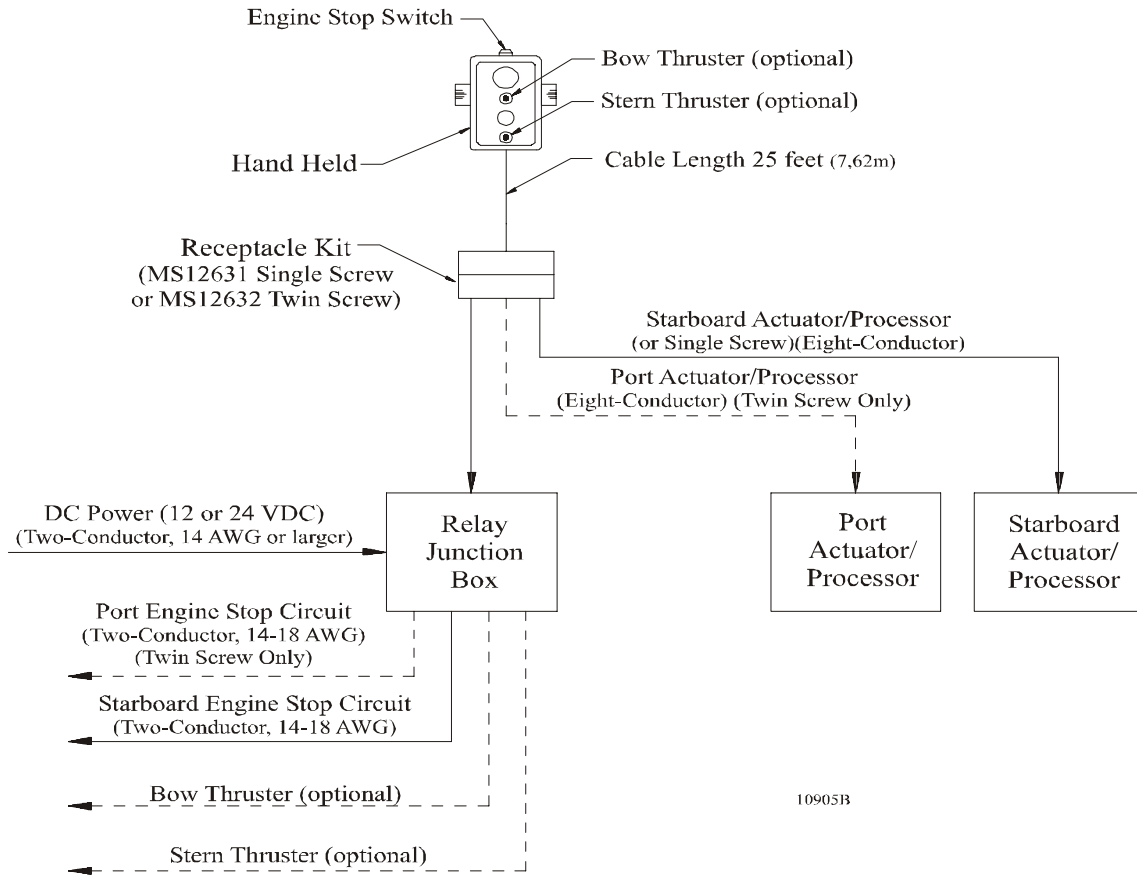


Figure 1: Pluggable Handheld Typical Cabling Diagram

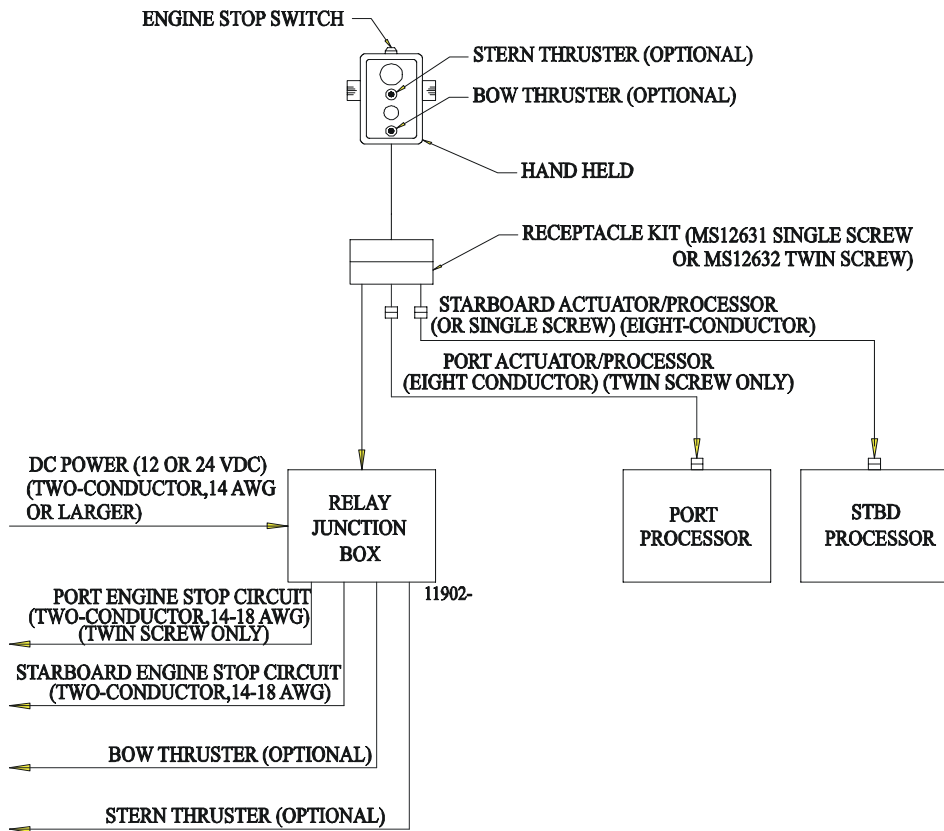


Figure 2: Plug'n'Play Typical Cabling Diagram

The Handheld connects to a plug Receptacle. This Receptacle is pre-wired with three cables that are labeled as to their connection points: (Refer to Figure 3:)

- One cable labeled RELAY JUNCTION BOX is for connection to the Junction Box
- One cable labeled PORT for Port and One cable labeled STBD for Starboard Actuator/Processor connections. (These two cables are terminated with Deutsch connectors for the Plug'n'Play versions only).

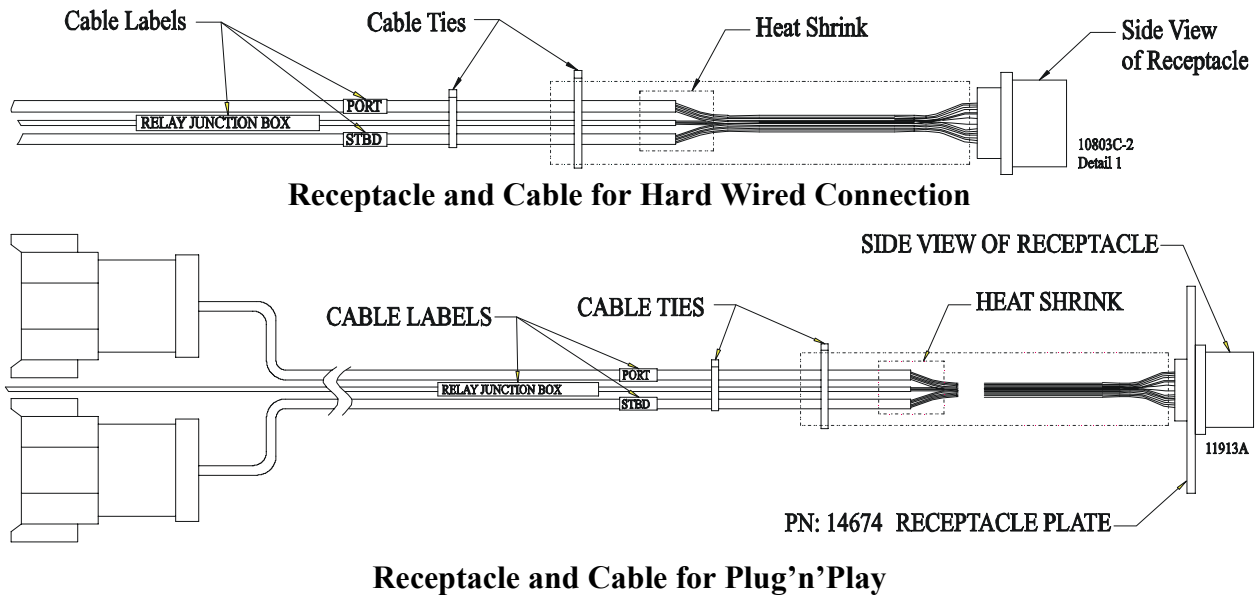


Figure 3: Side View of Receptacle and Cable

The Relay Junction Box is wired to (refer to “Figure 1:” on page 9 and “Figure 2:” on page 9):

- DC Power Supply
- Engine Stop Circuit (Port and Starboard for Twin Screw).
- One or Two Thrusters (optional).

2.3 SAFETY LANYARD

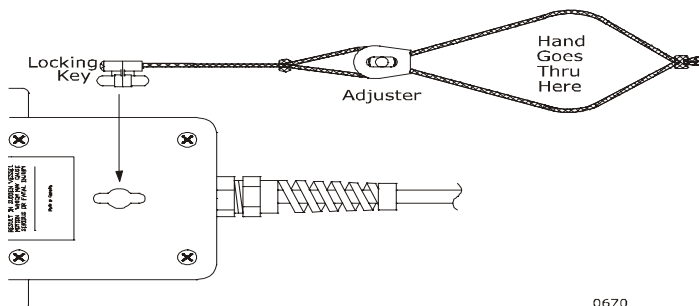


Figure 4: Safety Lanyard

The Handheld Unit is equipped with a Safety Lanyard with a **locking key**. This Safety Lanyard must be in place to allow operation of the Handheld. Refer to Figure 4:.

NOTE: DO NOT DISCARD LANYARD! The Handheld System will not operate the Actuator/Processor if the lanyard is not attached.

The lanyard is to be worn around the operator’s wrist during Handheld operation. In the event the locking key is pulled from its socket:

- The main engine speed will reduce to Idle RPM
- Clutch will shift to Neutral

The Handheld Station may not regain command until both the following have been accomplished:

- The locking key of the lanyard has been reinstalled in the Handheld Unit socket (refer to Figure 5:)
- The control knobs are in the vertical position. (Refer to Figure 6:)

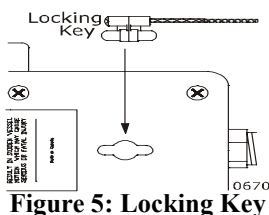


Figure 5: Locking Key

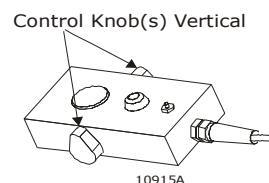


Figure 6: Control Knobs Vertical

Additional Lanyards are available, refer to “Table 2:” on page 24 for ordering information.

2.4 ENGINE STOP SWITCH

Engine Stop Switch

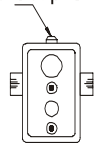


Figure 7: Engine Stop Switch

The Handheld is supplied with an Engine Stop Switch located at the top of the Handheld.

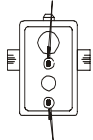
The Engine Stop Switch is **ALWAYS** operable when DC power is On to the Handheld System.

The Handheld System does not need to be in command of the Actuator/Processor to stop engines.

WARNING: Each Station must have some method to stop the engine. Connection of the Handheld Stop Switch to the engine(s) stop circuits is MANDATORY. Refer to CFR46, SEC. 62.35-5 and ABYC P-24.5.8.

2.5 THRUSTER COMMAND (OPTIONAL)

Stern Thruster (optional)



Bow Thruster (optional)

Figure 8: Thruster Switches

The Handheld Units for Thruster control are supplied with one or two Thruster switches. The Thruster switches are located above and below the Transfer Button on the Handheld Unit.

Thruster command is **ALWAYS** operable when DC power is On to the Handheld System.

The Handheld System does not need to be in command of the Actuator/Processor, or have the Safety Lanyard attached, to command the Thruster.

3.0 OPERATOR INSTRUCTIONS

3.1 SINGLE OR TWIN SCREW COMMAND

- A) The Station-in-Command Control Head levers may be left in any position.
- B) Move to the Handheld Station. Refer to Figure 9:.

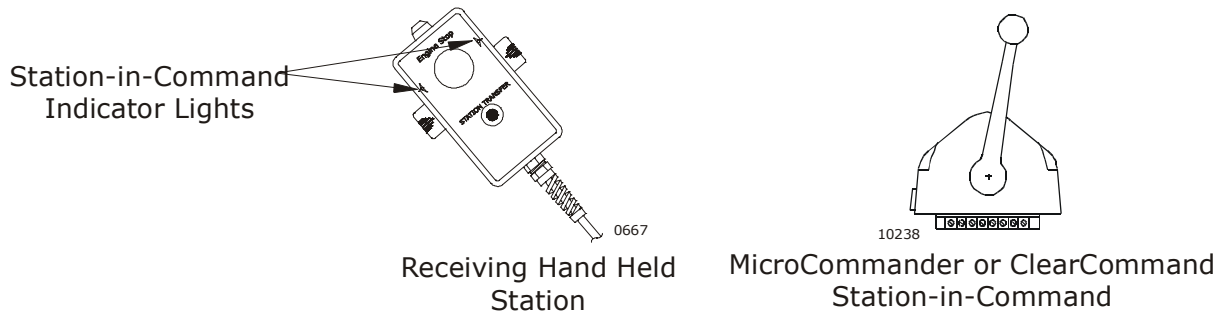


Figure 9: Station Transfer

- C) Ensure the Handheld control knobs are in the vertical position and that the Safety Lanyard is attached (refer to “Figure 4:” on page 4).

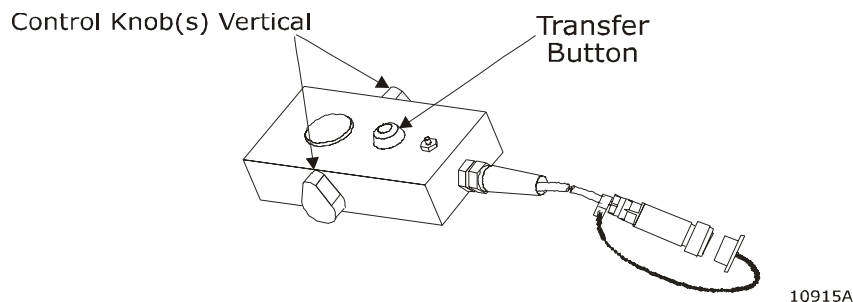


Figure 10: Taking Command at the Handheld

- D) Depress the Transfer Button to take command at the Handheld.
- E) The Station-in-Command red indicator lights next to the control knob(s) on the Handheld will light, indicating command has been transferred to the Handheld. (Refer to Figure 9:, page 12, for location of the indicator lights)

NOTE: On Twin Screw applications both Port and Starboard indicator lights on the Handheld Unit must be lit at the Handheld that is the Station-in-Command.

- F) The Handheld System is now ready to command the ZF Mathers Control System and optional Thrusters.

CAUTION: Operate the Handheld only while on the vessel . A person standing on the dock or another vessel should NEVER operate it. When using the Handheld the operator should brace themselves against any change in vessel motion.

The Handheld may be used:

- Secured in a holding bracket (refer to Figure 11:, page 13)
- Held freely in your hand while secured to the operator’s wrist by the safety lanyard

When the Handheld is not in use it should be placed within a holding bracket. Refer to “Table 2:” on page 24 for ordering information.

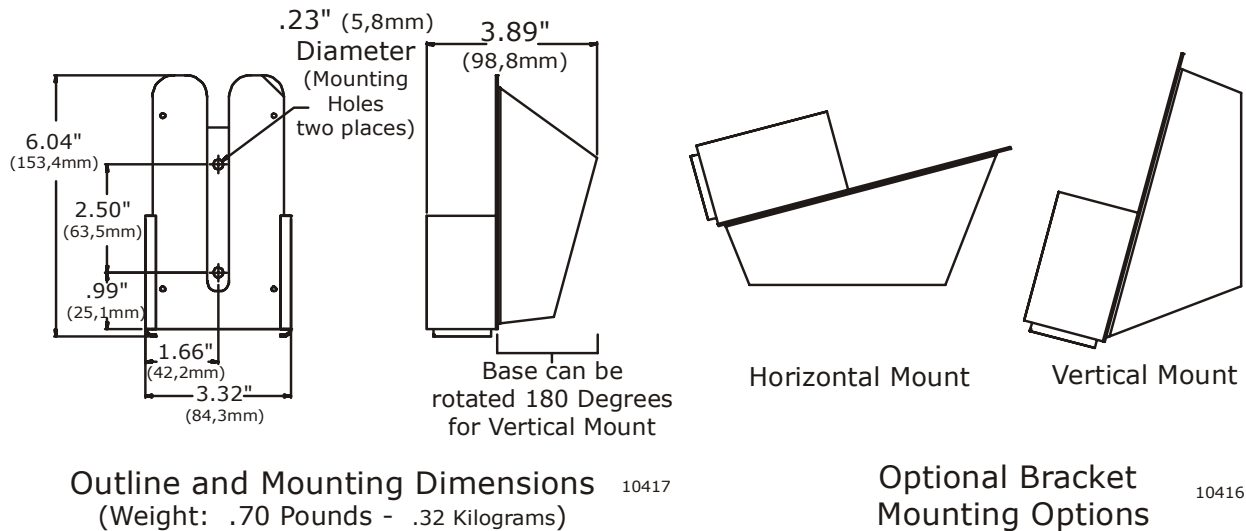


Figure 11: Optional Bracket Mounting

3.2 MOVING FROM ONE RECEPTACLE LOCATION TO ANOTHER

If a Handheld is to be moved to another Receptacle location:

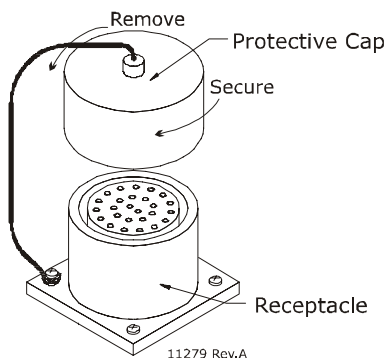


Figure 12: Receptacle Protective Cap

- Take command at one of the ZF Mathers Remote Stations.
- Unplug the Handheld from the Receptacle.
- Place the Protective Cap over the Receptacle.
- Turn Cap clockwise to secure.
- Move to another Receptacle location and turn the Cap counter-clockwise to remove.
- Plug Handheld into the new Receptacle.
- Take command at the Handheld.

3.3 THRUSTER CONTROL (OPTIONAL)

When one Thruster is used:

- The Thruster switch is located just below the Station Transfer Button on the Handheld.

When two Thrusters are used:

- Bow Thruster switch is located just above the Station Transfer Button
- Stern or second Bow Thruster switch is located just below the Station Transfer Button

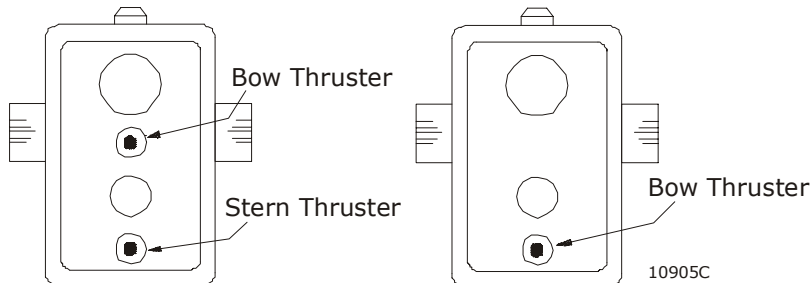


Figure 13: Bow & Stern Thruster Switches

The Thruster switch is spring centered to the OFF position.

- **By pressing and holding the switch Port or Starboard**, the Handheld Unit commands thrust from the thruster in either the Port or Starboard direction.
- **Holding the switch** will maintain thrust.
- **Releasing the switch** stops the thrust.

CAUTION: The thruster switch and Engine Stop Switch are ALWAYS active when power is supplied to the Handheld Unit. The Handheld does not need to be in command of the Actuators/Processors, nor does the safety lanyard need to be connected, in order to operate the thruster switch or the Engine Stop Switch.

4.0 REQUIRED PARTS AND TOOLS

4.1 ELECTRIC CABLE

Eight-Conductor Cable (Receptacle to Actuators/Control Processors/ Relay Junction Box)
Shielded 20 AWG, 300V, PVC Insulated: -20 degrees C to +80 degrees C.
UL VW-1 PVC Jacket. Color Coded.

Two Conductor Power Cable (Relay Junction Box to DC Power Supply)
14 AWG, 300V, PVC Insulated: -20 degrees C to +105 degrees C
UL VW-1 PVC Jacket. Red with purple stripe and black.

Two Conductor Cable (Engine Stop to Relay Junction Box)
14 -16 AWG, 300 V, PVC Insulated: -20 degrees C to +105 degrees C
UL VW-1 PVC Jacket. Yellow with red stripe.

Engine Stop Switch Cable (Engine to Relay Junction Box) (Port & Starboard)
Supplied by the installer. Refer to the information supplied with the Engine.

Thruster Cable (Thruster to Relay Junction Box)
Supplied by the installer. Refer to the information supplied with Thruster for cable specifications.

4.2 TOOLS REQUIRED FOR INSTALLATION

- Wago Tool
- Anti-static Wrist Strap
- Wire cutter, stripper, crimper (Recommend Thomas & Betts WT-2000)
- Screwdriver – med. Phillips #2
- Screwdriver – med. straight slot
- Screwdriver -- small straight slot
- Hole saw -- 1 inch _(25,4mm) [1.75 _(44,5mm) for Plug'n'Play]
- Drills -- 9/32 inch _(7,2mm) and 7/32 inch _(5,6mm)

4.3 HANDHELD REMOTE CONTROL

Included are:

- One Handheld Remote Control
- One extra Safety Lanyard with locking key
- One Receptacle Kit
- One Relay Junction Box
- Watertight cable grips
- Crimp Terminals

Optional Extras:

- Additional Receptacle Kits
- Receptacle Protector Kit
- 25 Foot _(7,62m) Extension Cable
- Holding Brackets
- Additional Handheld Units
- Additional Safety Lanyards

5.0 PLAN THE INSTALLATION

5.1 RECEPTACLE LOCATION

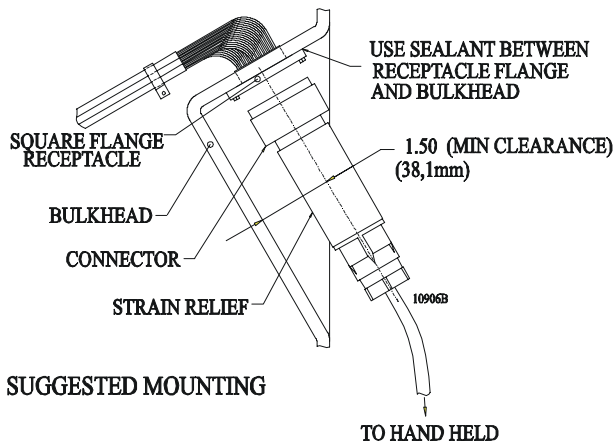


Figure 14: Receptacle Mounting Location

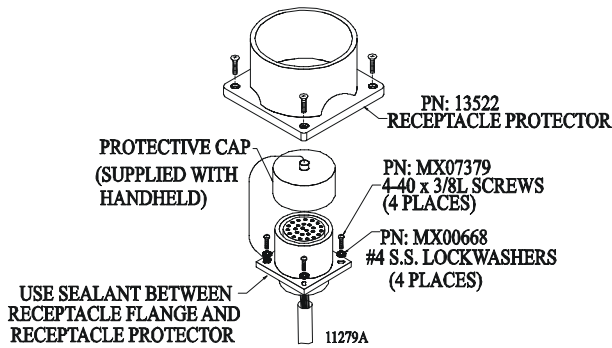


Figure 15: Receptacle Protector Assembly

5.2 HANDHELD LOCATION

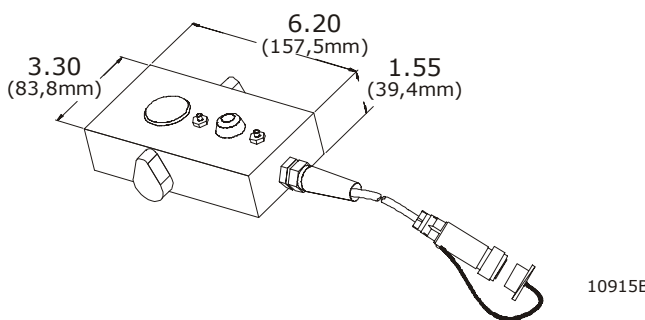


Figure 16: Handheld Dimensions

5.3 RELAY JUNCTION BOX LOCATION

Reference Figure 17:.

Considerations:

- The Relay Junction Box is water resistant, but should be mounted in a dry location.

Considerations:

- The Receptacle is water resistant, when sealant is used between the Receptacle flange and bulkhead.
- Strain relief is required for inside cable to ensure seal integrity. (See “Figure 20:” on page 19)
- Use the supplied protective cap and chain when Receptacle is not in use by the Handheld Unit. (Refer to Figure 15:)
- If Receptacle is to be mounted on the deck or area of bulkhead that is not protected, a Receptacle Protector should be used. Refer to Figure 15:.

Refer to “Figure 11:” on page 13 for optional Bracket Mounting Dimensions. It is recommended that the Handheld is stored in a Bracket Mount to protect the Handheld from damage when not in use.

PLAN THE INSTALLATION

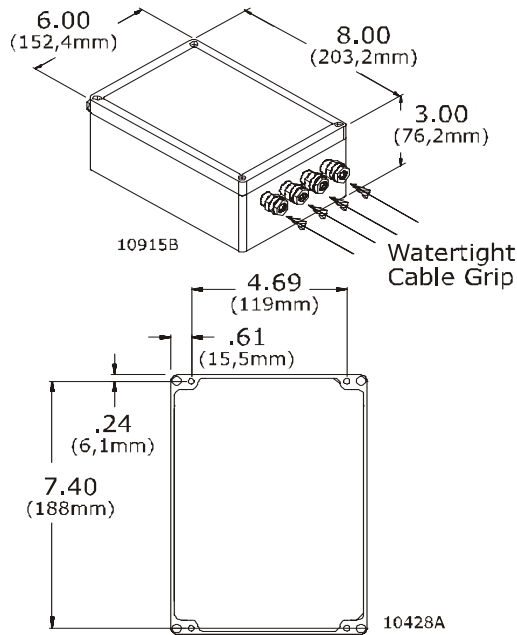


Figure 17: Relay Junction Box Dimensions

- Mount in any attitude easily accessible for electric connections. Bulkhead mount is preferred.
- Do not mount to the engine, or transmission, or any location that will allow excessive vibration.
- Locate away from heat sources, such as engine exhaust manifolds.
- The Relay Junction Box uses electronic circuits that can be influenced by strong magnetic fields, and static charges. Allow 4 feet (1,2m) of clearance between the Box and alternators or electric motors.

5.4 ENGINE STOP SWITCH

It is a requirement that Engine Stop Switches are available at all Stations. The Handheld contains an internal Engine Stop Switch that requires connection to the engine(s) stop circuit. This switch is ALWAYS active when power is supplied to the Handheld.

WARNING: Each Station must have some method to stop the engine. Refer to CFR 46, SEC. 62.35-5 and ABYC P-24.5.8.

5.5 DC INPUT POWER

The Relay Junction Box must be supplied with 12 or 24 VDC power supply protected by 2-ampere rated circuit breaker. The shipyard provides circuit breaker.

6.0 INSTALLATION

CAUTION: Static electricity can destroy electronic components. Anytime the Actuator/Processor cover is off, use an anti-static wrist strap and connect it to the Actuator/Processor frame. This will drain any static charge you may have on your person.

NOTE: Refer to the Technical Manual supplied with your MicroCommander, ClearCommand, or CruiseCommand Control System for reference when connecting the Handheld System to your current control system.

6.1 RELAY JUNCTION BOX

CAUTION: Static electricity can destroy electronic components. Connect the wrist strap provided to the Junction Box frame whenever working on the Box. This will drain any static charge you may have on your person.

CAUTION: When not working on the Relay Junction Box, keep the cover in place to prevent damage to circuits.

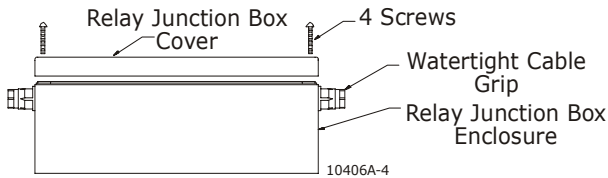


Figure 18: Relay Junction Box Parts

A) Remove the Relay Junction Box cover.

B) Mount the Relay Junction Box with 4 screws (included with Relay Junction Box). Refer to “Figure 17:” on page 17 for Relay Junction Box dimensions and location of mounting screw holes.

C) Replace the Relay Junction Box cover.

6.2 RECEPTACLE

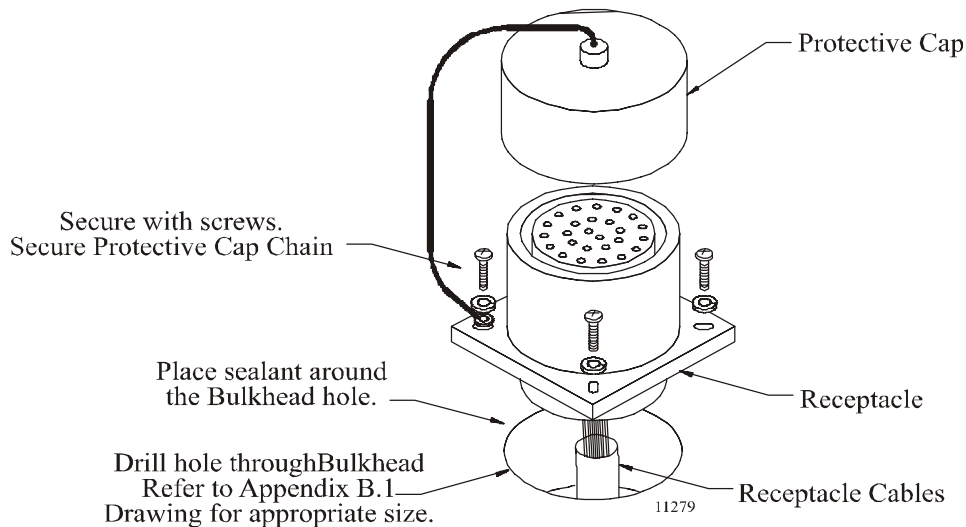


Figure 19: Receptacle Bulkhead Mounting

A) At the location decided to house the Receptacle, cut a hole through the bulkhead. Refer to the Appendix B.1 drawing for the type of Handheld being used for Receptacle Plate mounting dimensions and hole size of cutout.

- B) From the outside, feed Receptacle cables through the hole in the bulkhead.
- C) Place sealant around the bulkhead hole.
- D) Place Receptacle into the bulkhead hole.
- E) Secure with 4 screws. Use one of these screws to secure the protective cap's chain. (Protective cap and chain are supplied with the Receptacle Kit)

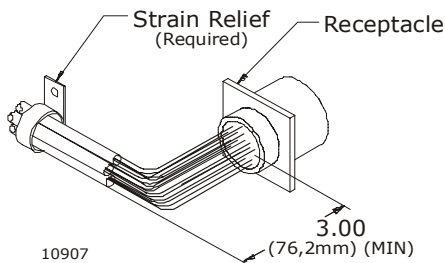


Figure 20: Receptacle Cable Strain Relief

- F) From the inside, secure the cable for strain relief. Strain relief is to be supplied by the installer.
- G) Once strain relief is complete, run the electrical cable labeled RELAY JUNCTION BOX to the Relay Junction Box location
- H) Depending the type of Handheld used:
 - run the PORT cable to the Port Actuator/Processor, STBD to Starboard Actuator/Processor.
 - Plug a Station Connection Cable into the Port Connector. Run the Station Connection Cable to the Port Actuator/Processor. Do the same for Starboard.

CAUTION: When installing the cable, support the cables using clamps or straps not more than 18 inches (0,5m) apart, unless contained in a conduit. Install each cable so it is protected from physical damage. Ensure cable is not under stress or strain at the Receptacle.

NOTE: When Receptacle is not in use, ensure the protective cap is in place.

CAUTION: When connecting plugs, ensure that the release button or buttons are depressed and held until plug is fully connected or disconnected.

NOTE: Additional Receptacles are available. (Refer to “Table 2:” on page 24

CAUTION: Two Receptacles can be wired to the same location at the Relay Junction Box, but **MUST** be wired to their OWN Station Terminal at the Actuator/Processor.

6.2.1 Receptacle Protector with Hardwired Receptacles (Optional)

See Figure 21: for Receptacle Protector dimensions.

- A) Drill four mounting screw holes at mounting location.
- B) Place Receptacle Protector over the Receptacle.
- C) Secure Receptacle Protector to bulkhead with 4 screws.

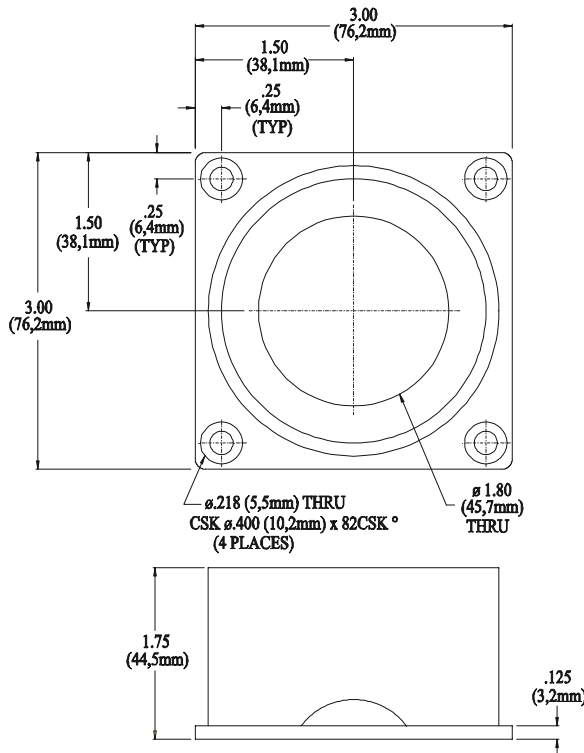


Figure 21: Receptacle Protector Dimensions

6.2.2 Receptacle Protector with Plug'n'Play Receptacles (Optional)

See Figure 21: for Receptacle Protector dimensions.

- A) Remove the four screws holding the Receptacle to the Bulkhead
- B) Place Receptacle Protector over the Receptacle.
- C) Secure Receptacle Protector and the Receptacle to the bulkhead using the 4 screws removed in Step A).

6.3 RECEPTACLE CABLE TO RELAY JUNCTION BOX

CAUTION: When installing the cable, support the cables using clamps or straps not more than 18 inches (0,5m) apart, unless contained in a conduit. Install each cable so it is protected from physical damage. Ensure cable is not under stress or strain at the Receptacle. Refer to Figure 20:, page 19.

- A) Remove the Relay Junction Box cover. (refer to Figure 18:)
- B) Run the cable labeled **RELAY JUNCTION BOX** through a watertight connector supplied on the Relay Junction Box.
- C) Strip the cable jacket then strip the black, red, orange, brown, green, and yellow wires 3/8-inch (9,5mm).
- D) Install the fork crimp terminals included with Relay Junction Box onto the ends of the wires. (Thomas & Betts PNF18-6SLF or equal)
- E) Make the cable connections within the Relay Junction Box as indicated on “Figure 22:” on page 21.

F) Replace Relay Junction Box cover.

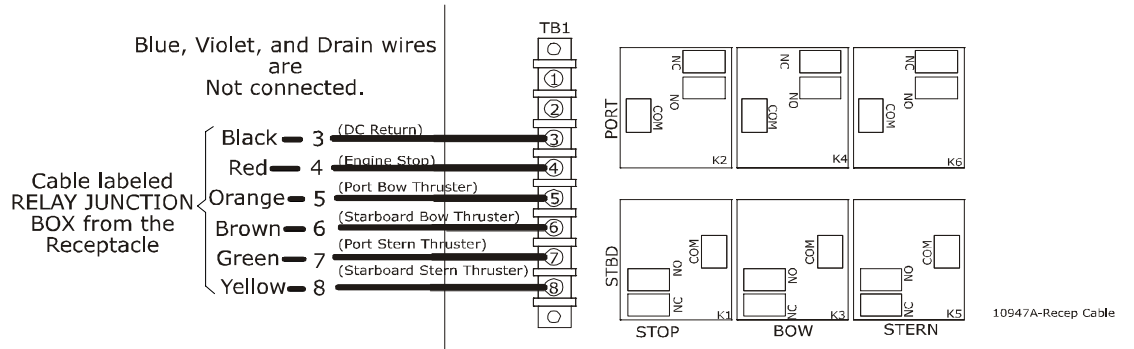


Figure 22: Junction Box Receptacle Cable Wiring Diagram

NOTE: Additional Receptacles are available. (Refer to “Table 2:” on page 24)

CAUTION: Two Receptacles can be wired to the same location at the Relay Junction Box, but **MUST** be wired to their OWN Station Terminal at the Actuator/ Processor.

6.4 POWER CABLE INSTALLATION

WARNING: When connecting or disconnecting the DC power cables to the Relay Junction Box, be sure the power is OFF.

A) Run the length of two-conductor power cable between the DC Power Supply and the Relay Junction Box.

CAUTION: When installing the cable, support the cables using clamps or straps not more than 18 inches (0,5m) apart, unless contained in a conduit. Install each cable so it is protected from physical damage. Refer to Figure 20:, page 19.

B) Remove the Relay Junction Box cover. (see “Figure 18:” on page 18)

C) Run the cable through a watertight connector supplied on the Relay Junction Box.

D) Strip cable Jacket then strip each wire 3/8-inch (9,5mm).

E) Install fork crimp terminals included with Relay Junction Box. (Thomas & Betts PNF14-6SLF or equal)

F) Connect two-conductor cable.

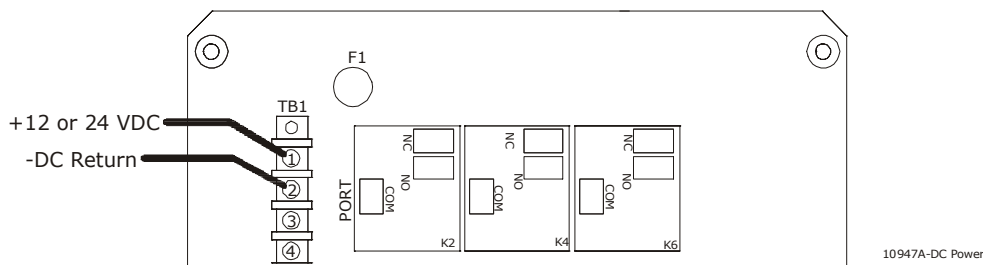


Figure 23: Junction Box Power Cable Wiring Diagram

G) Replace Relay Junction Box cover.

6.5 ENGINE STOP CABLE INSTALLATION

A) Install the cable between the Relay Junction Box and the Engine Stop Circuits.

CAUTION: When installing the cable, support the cables using clamps or straps not more than 18 inches (0,5m) apart, unless contained in a conduit. Install each cable so it is protected from physical damage.

B) Remove the Relay Junction Box cover. (see “Figure 18:” on page 18)

C) Run the cables through a watertight connector supplied on the Relay Junction Box.

D) Strip cable jacket and then strip each wire 3/8-inch (9,5mm).

E) Install female crimp terminals included with Relay Junction Box. (Thomas & Betts RB14-250F or equal)

F) Select contacts to be used (connection to Normally Open Contacts shown).

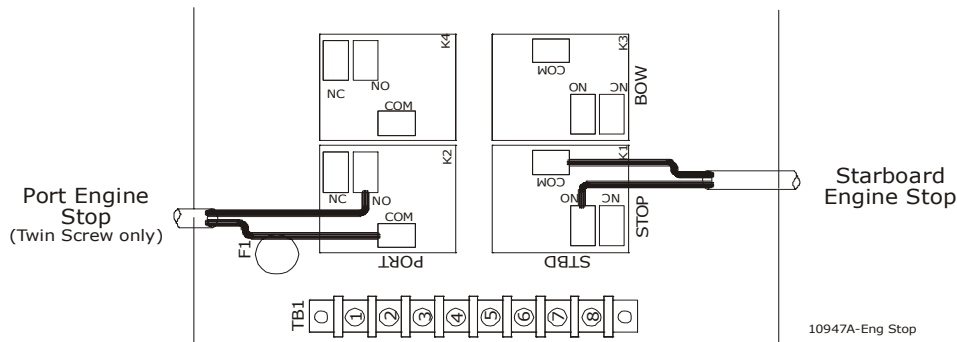


Figure 24: Junction Box Engine Stop Cable Wiring Diagram

CAUTION: The Engine Stop Relays have normally open (maximum 20-ampere) and normally closed (maximum 10-ampere) contacts. The normally open contacts are typically used for fuel shut-off solenoids and should be wired in parallel with any existing fuel shut-off circuits. The normally closed contacts are used with ignition circuits and should be wired in series with any existing ignition circuits.

G) Replace the Relay Junction Box cover.

H) Refer to the information supplied by your engine dealer for connection to the Engine Stop Circuits.

6.6 THRUSTER CABLE INSTALLATION (OPTIONAL)

Install the Thruster cable between the Relay Junction Box and the Thruster solenoid(s).

CAUTION: When installing the cable, support the cables using clamps or straps not more than 18 inches (0,5m) apart, unless contained in a conduit. Install each cable so it is protected from physical damage.

6.6.1 Thruster Cable Connection at Junction Box

- A) Remove the Relay Junction Box cover. (Refer to “Figure 18:” on page 18)
- B) Run the cable through a watertight connector supplied on the Relay Junction Box.
- C) Strip the cable jacket then strip each wire 3/8-inch (9,5mm).
- D) Install female crimp terminals included with Relay Junction Box. (Thomas & Betts RB14-250F or equal)
- E) Make cable connections at the Relay Junction Box as indicated in Figure 25:.

CAUTION: Use Only ONE set of Normally Open (N.O.) Contacts per Thruster.

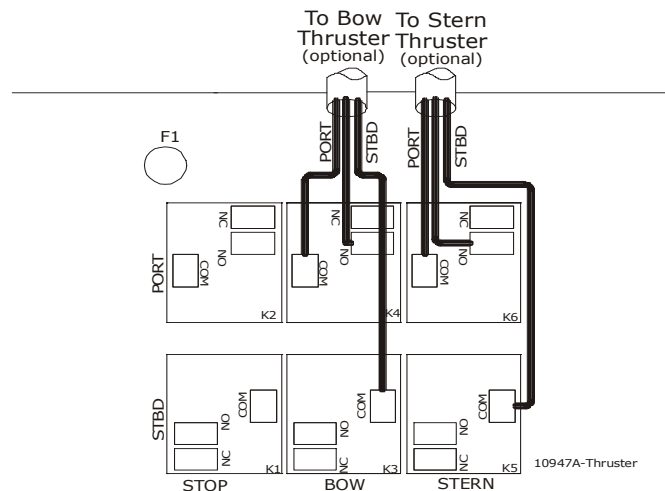


Figure 25: Junction Box Thruster Cable Wiring Diagram

- F) Replace Relay Junction Box cover.

6.6.2 Thruster Cable Connections at the Thruster

- A) Make connections at the Thruster. Refer to the information supplied with the Thruster and Figure 26:, page 24.

CAUTION: The Thruster Relays have normally open (maximum 20-ampere) and normally closed (maximum 10-ampere) contacts.

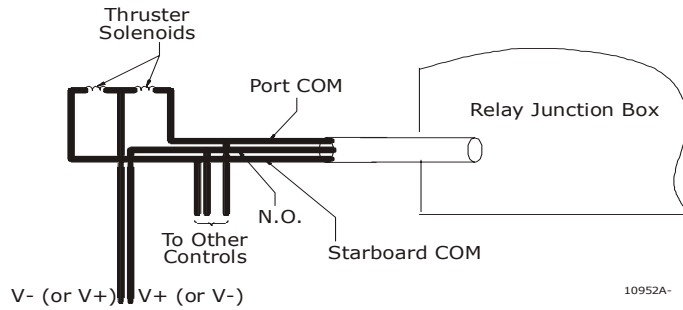


Figure 26: Typical Connections at Thruster

6.7 RECEPTACLE CABLE INSTALLATION TO ACTUATOR/PROCESSOR

6.7.1 Port and Starboard Hardwire Receptacle Connection

Run 8-conductor cable labeled PORT from the Receptacle to the Port Actuator/Processor, and the 8-conductor cable labeled STARBOARD to the Starboard Actuator/Processor.

CAUTION: When installing the cable, support the cables using clamps or straps not more than 18 inches (0,5m) apart, unless contained in a conduit. Install each cable so it is protected from physical damage.

NOTE: For Twin Screw Applications repeat the following on both the Port and Starboard Actuator/Processor.

- A) Remove the Actuator/Processor cover.
- B) Connect the wrist strap to your person, and the ground connector to the Actuator/Processor frame.

CAUTION: When not working on the Actuator/ Processor, keep the cover in place to prevent damage to circuits.

- C) Install a watertight cable grip on the Actuator/Processor.

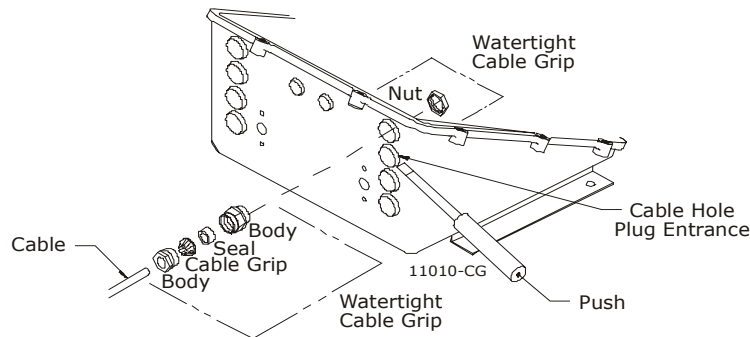


Figure 27: Actuator/Processor Watertight Cable Grip Installation

- D) Strip the PVC jacket and shielding back approximately 3 inches (75mm).

CAUTION: Stagger wire lead length to match the Station terminal strip. Wire leads must not touch frame.

NOTE: The Handheld may be connected on any unused Station Terminal strip within the Actuator/Processor. For Twin Screw Applications ensure connection of the Handheld on both Port and Starboard Actuator/Processors are the same numbered Station Terminal. A jumper is required between terminals 5 and 6 on all unused Station Terminals on the Actuator/Processor circuit board.

NOTE: A WAGO Tool is supplied with each Actuator/Processor.

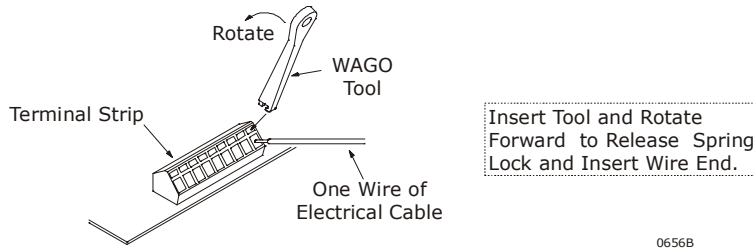


Figure 28: WAGO Tool

0656B

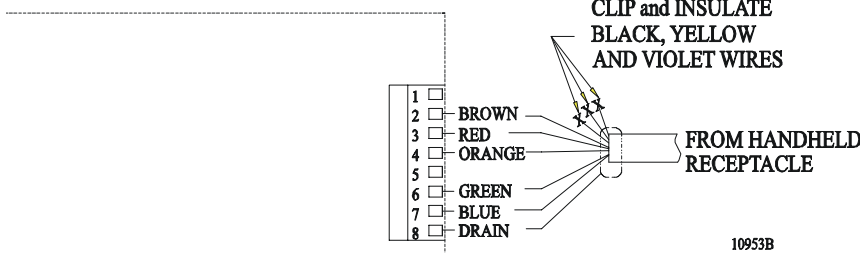


Figure 29: Typical Connections at Actuator/Processor

10953B

- E) Strip the wire 3/8-inch (9,5mm) on each lead.
- F) Use a WAGO tool to depress the spring lock for the individual wire connection to the terminal strip.
- G) Connect colors as shown on Figure 29:.
- H) Connect the shielding drain wire (bare non-insulated wire) to Terminal 8 on the terminal strip.

CAUTION: The shielding drain wire **MUST NOT** touch any other components or Frame.

- I) Feed through a little slack cable, and tighten the cable grip on the cable.
- J) Use a cable tie to secure cable to Actuator/Processor frame.

6.7.2 Port and Starboard Plug'n'Play Connection

- A) Run the Station Connection Cable from the Receptacle to the Port and Starboard Actuator/Processor
- B) Connect on any unused Station connector.

NOTE: For Twin Screw Applications ensure connection of the Handheld on both Port and Starboard Actuator/Processors are the same numbered Station connector.

CAUTION: When connecting plugs, ensure that the release button or buttons are depressed and held until plug is fully connected or disconnected.

7.0 ADJUSTMENTS AND TESTS (SECURED TO DOCK)

7.1 HANDHELD UNIT (ENGINES STOPPED)

- A) Turn On power to the Control System
- B) Plug Handheld Unit into a Receptacle by turning the plug clockwise into the receptacle sleeve until secure.
- C) Take command at the Handheld Unit by depressing the transfer button.
- D) Verify command indicator lights (LED) are lit.
- E) Move the Handheld control knob fully one way, then the other.
 - Ensure MicroCommander/ClearCommand/CruiseCommand System reacts correctly to the control knob command.
- F) Verify command is correct.
- G) Refer to your original MicroCommander/ClearCommand/CruiseCommand Manual for further testing of Control Heads

NOTE: If more than one Receptacle has been installed, do Handheld System testing at EACH Receptacle to ensure Receptacle hook-up is correct.

7.2 ENGINE STOP SWITCHES TEST (ENGINES RUNNING)

- A) Start engine(s).
- B) Plug Handheld into a Receptacle by turning the plug clockwise into the receptacle sleeve until secure.
- C) Verify that the Engine Stop Switch on the Handheld stops the engine when switch is depressed.

NOTE: If more than one Receptacle has been installed, do Engine Stop Switch testing at EACH Receptacle to ensure Receptacle hook-up is correct.

The Engine Stop Switch is ALWAYS operable when DC power is On to the Handheld System. The Handheld System does not need to be in command of the Actuator/Processor, or have the Safety Lanyard attached, to stop engines.

WARNING: DO NOT attempt to continue tests if the Engine Stop Switch does not function correctly. Refer to information supplied by engine manufacturer or supplier for set-up and adjustments. Refer to CFR 46, SEC. 62.35-5 and ABYC P-24.5.8.

7.3 OPTIONAL THRUSTER SWITCH TEST (ENGINES RUNNING)

The Thruster switch is ALWAYS operable when DC power is On to the Handheld System. The Handheld System does not need to be in command of the Actuator/Processor, or have the Safety Lanyard attached, to operate Thrusters.

- A) Plug Handheld into a Receptacle by turning the plug clockwise into the receptacle leave until secure.
- B) Press the Thruster switch Port and Starboard.
- C) Verify corresponding Thruster is operating. If Thruster is not operating correctly, check all connections and retest.

NOTE: If more than one Receptacle has been installed, do Thruster Switch testing at EACH Receptacle to ensure Receptacle hook-up is correct.

8.0 ADJUSTMENTS AND TESTS (UNDERWAY)

WARNING: Verify that all previous tests are completed and are correct. Only then is the vessel ready to leave the dock. **DO NOT** attempt to operate the Handheld away from the dock with any system abnormality.

CAUTION: Start slowly and learn to appreciate that the Handheld Unit provides a light touch that is fast and accurate.

- A) Apply DC power to the Handheld System.
- B) The Control Head at each remote station will produce an intermittent tone.
- C) Verify that Handheld Knobs are in the vertical position. Refer to “Figure 10:” on page 12.
- D) Depress the Transfer Button on the Handheld. The red indicator light on the Handheld Unit should light, showing that the Handheld is now in command. (Note that both red indicator lights must be lighted on dual Handhelds.)
- E) Move the Handheld Knobs full-Ahead and full-Astern. This will check that the Handheld is operating.

NOTE: When the Handheld is the Station-in-Command, throttle is limited to 80% of full Throttle when in full-Ahead and full-Astern.

9.0 MAINTENANCE

9.1 HANDHELD UNIT AND RELAY JUNCTION BOX

The Handheld, Receptacle, and Relay Junction Box do not require scheduled maintenance, but should be inspected periodically for cracked, frayed, or damaged cable covering. Verify watertight integrity of buttons and switches.

10.0 PARTS SOURCE

Table 2: lists the Handheld System's Parts available from ZF Mathers, LLC. Contact Inside Sales at ZF Mathers (1-800-546-5455).

The Handheld System is available as an additional Station for MicroCommander, ClearCommand, and CruiseCommand Systems

Table 2: Parts List

Part Name	ZF Mathers Part No.	Manufacturer Part No.
Anti-Static Wrist Strap	AWCC	Thomas & Betts Part No. AWCC
Fuse	TR5-M-1	Wickman Part No. TR5-M-1
WAGO Tool	236-332	WAGO Part No. 236-332
Receptacle Kits: SINGLE SCREW (Hardwired) 50 foot (15,24m) cable 100 foot (30,48m) cable 150 foot (45,72m) cable TWIN SCREW 50 foot (15,24m) cable 100 foot (30,48m) cable 150 foot (45,72m) cable 200 foot (60,96m) cable	<u>Hardwired</u> MS12631-50 MS12631-100 MS12631-150 MS12632-50 MS12632-100 MS12632-150 MS12632-200	<u>Plug'n'Play</u> MS12631-50P MS12631-100P MS12631-150P MS12632-50P MS12632-100P MS12632-150P MS12632-200P
Station Connection Cable (Plug'n'Play Only)	14261-X (X reflects Cable length)	
Receptacle Protector Assembly	13523	
Extension Cable [25 foot (7,62m)] Single Screw Twin Screw	MS12935 MS12772	
Bracket Mounting Assembly	1233	
Safety Lanyard	81237	Comnav Part No. 81237

Table 2: Parts List

Part Name	ZF Mathers Part No.	Manufacturer Part No.
Handheld: [25 foot (7,62m) cable) SINGLE SCREW Main Engine Control Only Main Engine Control - One Thruster Main Engine Control - Two Thruster TWIN SCREW Main Engine Control Only Main Engine Control - One Thruster Main Engine Control - Two Thruster	 12978 12980 12982 12979 12981 12983	
Relay Junction Box	12984	
Technical Manual	MM12822	

PARTS SOURCE



References

A) REFERENCES

1. American Boat & Yacht Council (ABYC)
3069 Solomons Island Road
Edgewater, MD 21037-1416
E-3 Wiring Identification on Boats
E-9 DC Electrical Systems on Boats
H-2.4e or 32.4g Ambient Temp. 50 degrees C
P-24 Electric/Electronic Propulsion Controls
2. Code of Federal Regulations
33 CFR 183 Subpart I - Electrical Systems
33 CFR 183.410 Ignition protection
33 CFR 183.415 Grounding
33 CFR 183.425 Conductors: General
33 CFR 183.430 Conductors in circuit of less than 50 Volts
33 CFR 183.445 Conductors: Protection
33 CFR 183.455 Over-current and Protection: General
46 CFR 111.01 - 15(b) Ambient Temp. Machinery Spaces 50 degrees C
46 CFR 111.05- System Grounds
3. Society of Automotive Engineers
400 Commonwealth Drive
Warrendale, PA 15096
J1171 External Ignition Protection
J1428 Marine Circuit Breakers
J378 Marine Engine Wiring
4. National Marine Manufacturers Association
401 North Michigan Avenue
Chicago, IL 60611
5. Underwriters Laboratories

APPENDIX A.1

1.0 TROUBLESHOOTING

As far as the Actuator or Processor is concerned, the Handheld Remote operates in the same fashion as a standard fixed Remote Control Station. Therefore, troubleshooting a suspected malfunctioning Handheld may be approached in a similar fashion.

1.1 QUESTIONS TO ASK BEFORE BEGINNING TROUBLESHOOTING

Prior to getting heavily involved in making measurements with a Voltmeter, it is advisable to find the answers to the following questions:

A) How many Control Stations are there on the vessel?

- The Handheld must never be used as the Primary Control Station. Therefore, there should be at least one other Station. Check the operation of the Control System from the other Station(s).
- If the problem occurs from more than one Control Station, the odds are that the Handheld Remote is not the cause of the malfunction.
- If the problem only occurs at the Handheld Remote, then further tests of that Handheld would be warranted.

B) Are the Remote Handheld's LED(s) lit?

Understanding these various LED states, may help point you into the correct direction, or uncover the fact that what is perceived as a problem may actually be a Mode of Operation.

- The LED(s) will be in one of four states.
 1. Lit Steady
 2. Not Lit
 3. Blinking Slowly
 4. Blinking Rapidly
- When the LED is "Lit Steady", this indicates that the Handheld Remote is in command and in a normal operative mode.
- When the LED is "Not Lit", that station, on that side, is currently not in command.

- A “Slow Blinking” LED indicates that the Handheld Remote is currently in “Warm-up Mode”.
- An LED which is “Blinking Rapidly”, indicates that the system is operating in “Troll Mode”.

C) Are any tones generated when the problem occurs?

- The Handheld Remote does not have a Sound Transducer and therefore does not produce any tones. Since a vessel must have at least one Fixed Remote Station, which does have a Sound Transducer, a tone could be heard if one were generated.
- Depending on whether the Handheld is connected to a ClearCommand or a MicroCommander system, up to seven different tones could be generated. These tones are as follows:
 1. **Slow Repetitive-** This tone indicates that power has just been applied to the Control System and no Remote Control Station is in command. This tone cannot be a result of a Handheld Remote problem.
 2. **Fast Repetitive-** This tone indicates a “Servo Jam” or the inability of the Push-pull cable to get to a commanded position. Once again, the Remote Handheld cannot be the cause of this tone.
 3. **Steady-** This indicates that voltage has dropped too low to the Actuator/Processor or that a component has failed on it’s Circuit Board. In either case, the problem cannot be caused by the Handheld Remote.
 4. **Tone Over Tone-** This is a tone which indicates a potential problem with command of a Trolling Valve. This is not something which can be caused by the Handheld Remote
 5. **One Long/ One Short-** Indicates that the number 1 Servo’s feedback is out of range. This cannot be caused by the Handheld Remote.
 6. **One Long/ Two Short-** Indicates that the number 2 Servo’s Feedback is out of range. This cannot be caused by the Handheld Remote.
 7. **One Long/ Three Short-** This tone indicates the Command Signal of the Station-in-Command is out of range. Unlike all of the previous tones, this one may indicate a problem with the Handheld

Remote. Details for testing this can be found in the “Command Signal Testing” Section 1.4, page 4.

1.2 INSPECTION OF SYSTEM

Once you have the answers to the above questions, there is a very good chance you have pretty good idea as to what could be causing the trouble. In any case, before you get heavily into troubleshooting, it is a good practice to review the Drawing in Appendix B.1. Become familiar with the various components listed and their location on the vessel.

Carefully inspect the following:

- Are the components installed in a location which is consistent with the recommendations of this manual?
- Is the condition of the various components acceptable?
- Are the interconnecting wires terminated properly and free of corrosion?

The primary function of a Handheld Remote is to control a vessel’s speed and direction. If a malfunction were to occur, it would more than likely fall into one of the following categories:

- Cannot gain command with the Handheld
- The actual Throttle/Gear selected is different then what is commanded.
- Command is lost (returns to Neutral and Idle).

1.3 TAKING COMMAND

In order to take command with a Handheld Remote, two things must be true.

1. The Handheld’s “Command Signal” must be at the Neutral/ Idle position.
2. The Handheld’s “Station Select” signal must be pulled low when the Transfer Button is depressed.

1.4 COMMAND SIGNAL TESTING

This signal should be tested at the Actuator or Processor. The signal is tested as follows:

- A) Measure the DC Voltage at Pins 5 and 7 (yellow and blue wires) at the Processor or Actuator Station to which the Handheld is connected. This is referred to as the Reference Voltage (Vref). The measurement should be between 4.80 to 5.00 VDC.
- B) Measure the DC Voltage between Pins 5 and 6 (yellow and green wires). This is the Command Voltage. With the Handheld commanding the Neutral/ Idle the measurement must be 48 to 50% of Vref.

1.5 STATION SELECT TESTING

This signal should be tested at the Actuator or Processor and is tested as follows:

- A) Measure the DC Voltage at pins 3 and 4 (red and yellow wires). The measurement should be 4.80 to 5.00 VDC.
- B) Continue to measure the DC Voltage at Pins 3 and 4 while the Handheld's Transfer Button is being depressed. The measurement should be < 0.50 VDC.

1.6 LIST OF POSSIBLE SYMPTOMS AND SOLUTIONS

If a problem were to arise with the Handheld Remote, the following are some of the most likely problems you may encounter and their possible solutions. In the event that you experience a problem not listed below, you should be able to identify the cause using the information provided above.

Symptom	Checks	Solution
1. Cannot take command at Handheld when the Transfer Button is depressed.	1. Verify that the Safety Lanyard is installed. <ul style="list-style-type: none"> 1a. The Command Voltage is not between 48- 50% of Vref. 1b. Test The Station Select circuit. 	1. Plug in the Safety Lanyard. <ul style="list-style-type: none"> 1a. The Handheld's Knob is not positioned at the Neutral/ Idle position. Reposition. The yellow, green or blue wire is loose or incorrectly terminated. Correct. 1b. The red or orange wire(s) are not connected properly. The Transfer Button is defective (replace the Handheld).

TROUBLESHOOTING

Symptom	Checks	Solution
2. The Engine Shut-down does not operate.	2. DC power is turned 'Off' going to the Junction Box. 2a. The Junction Box fuse is blown. 2b. The positive and negative power leads are reversed.	2. Turn power 'On' to the Junction Box. 2a. Replace fuse "F1". 2b. Correct the polarity of the power going to the Junction Box.
3. The Bow and or Stern Thruster(s) are inoperable.	3. DC power is turned 'Off' going to the Junction Box. 3a. The Junction Box Fuse is blown. 3b. The positive and negative power leads are reversed.	3. Turn power 'On' to the Junction Box. 3a. Replace fuse "F1". 3b. Correct the polarity of the power going to the Junction Box.
4. Control is lost for no apparent reason and the Gears and Engines go to Neutral/ Idle.	4. A loose Safety Lanyard is suspected if both port and starboard loose control. 4a. A loose connection of the yellow, green or blue wire. 4b. There's a defective potentiometer in the Handheld.	4. Properly install the Safety lanyard. 4a. Check the connections and perform the Command Signal Test. 4b. Replace the Handheld.

1.7 STATION CONNECTION CABLE PIN-OUT (PLUG'N'PLAY ONLY)

PROCESSOR		CONTROL HEAD	
Termination A	Conductor Color	Termination B	Description
8-1	Green/ Yellow	N/C	Chassis
8-2	Brown	Pin 2	LED Power (2.10- 4.20 VDC)
8-3	Violet	Pin 8 (Starboard side only)	- DC Return for green LED
8-4	Orange	Pin 4	Station Select/ Transfer Button (5.00 VDC, 0.00 VDC when depressed)
8-5	Red	Pin 5 (Right Hand) Pin 7 (Left Hand)	Analog Ground
8-6	Green	Pin 6	Command Signal (0.60- 4.40 VDC)
8-7	Blue	Pin 7 (Right Hand) Pin 5 (Left Hand)	VREF/ Reference Voltage (4.80- 5.00 VDC)
8-8	Black	Pin 1	Alarm Tone (20- 25 VAC when present, 20- 25 VDC when not present)

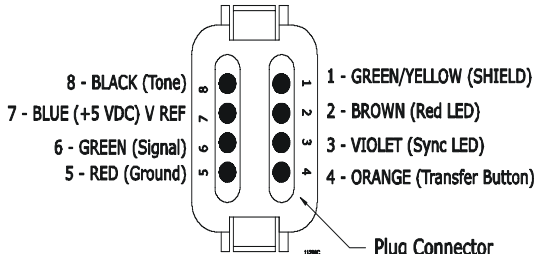


Figure 1: Control Head Harness Pin Out

TROUBLESHOOTING

APPENDIX B.1

Drawing 11442B No Thrusters - Single Screw [PN: 1213-1]

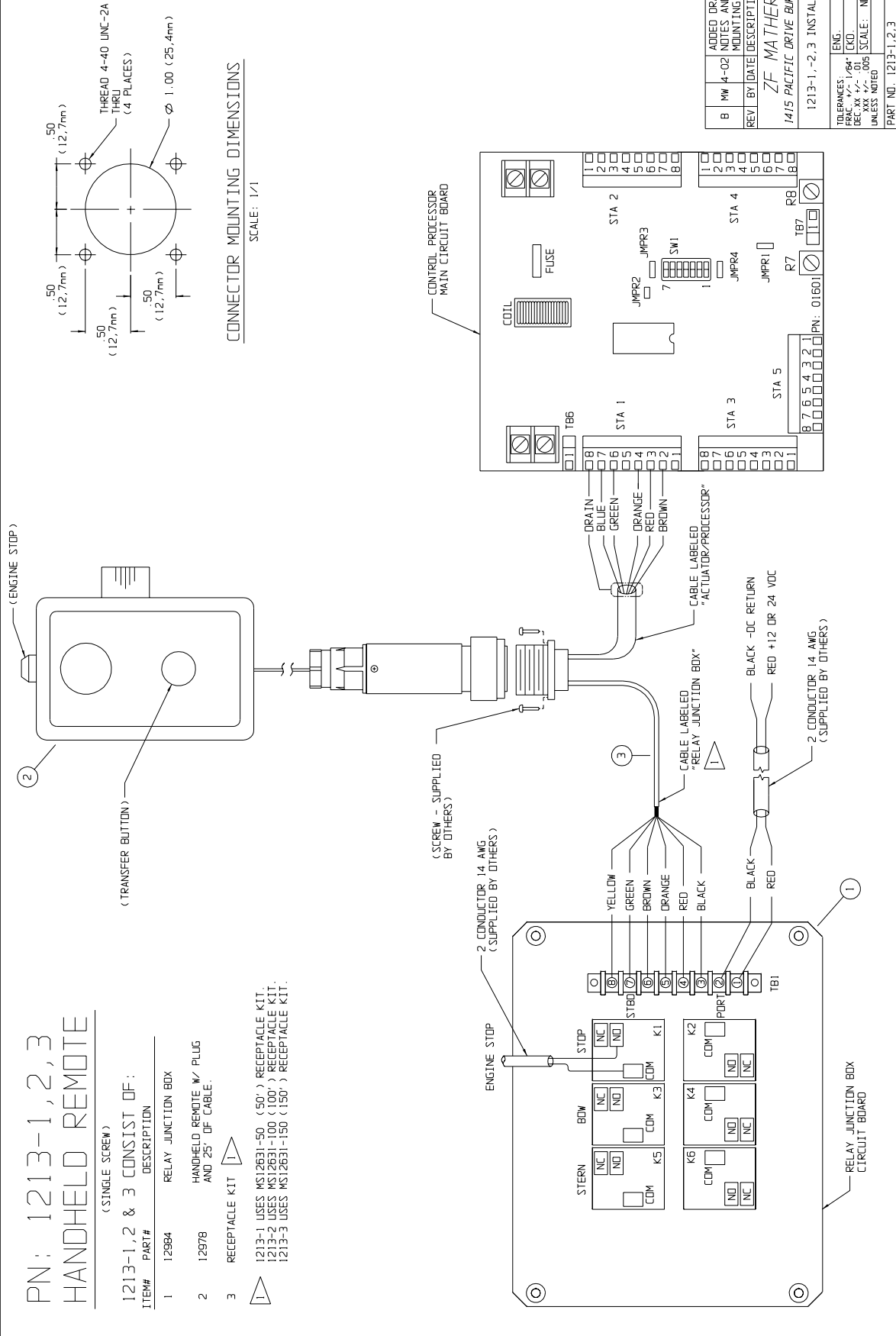
PN: 1213-1, 2, 3
HANDHELD REMOTE

(SINGLE SCREW)

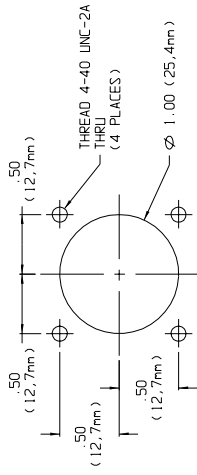
1213-1, 2 & 3 CONSIST OF:

ITEM#	PART#	DESCRIPTION
1	12984	RELAY JUNCTION BOX
2	12978	HANDHELD REMOTE W/ PLUG AND 25' OF CABLE.
3	RECEPTACLE KIT	

1213-1 USES MS12631-50 (50') RECEPTACLE KIT.
 1213-2 USES MS12631-100 (100') RECEPTACLE KIT.
 1213-3 USES MS12631-150 (150') RECEPTACLE KIT.



CONNECTOR MOUNTING DIMENSIONS
SCALE: 1/1



B	MM	4-02	ADDED DRAWING FORMAT, JC MOUNTING DIMENSIONS.
REV	BY	DATE	DESCRIPTION
			CKD
ZF MATHERS, LLC			
1415 PACIFIC DRIVE BURLINGTON WA - 98233			
1213-1,-2,3 INSTALLATION DRAWING			
TOLERANCES:	UNLESS NOTED	UNLESS NOTED	UNLESS NOTED
FINISH:	UNLESS NOTED	UNLESS NOTED	UNLESS NOTED
DATE:	3-25-02	DATE:	3-25-02
SCALE:	NONE	SCALE:	NONE
SHT.	1 OF 1	SHT.	1 OF 1
SIZE:	B	SIZE:	B
PART NO.:	1213-1,2,3	DWG. NO.:	11442
ENGR.:	M. WILSON	ENGR.:	M. WILSON

Drawing 11901 No Thrusters - Single Screw [PN: 1213-1P, 2P, -3P]

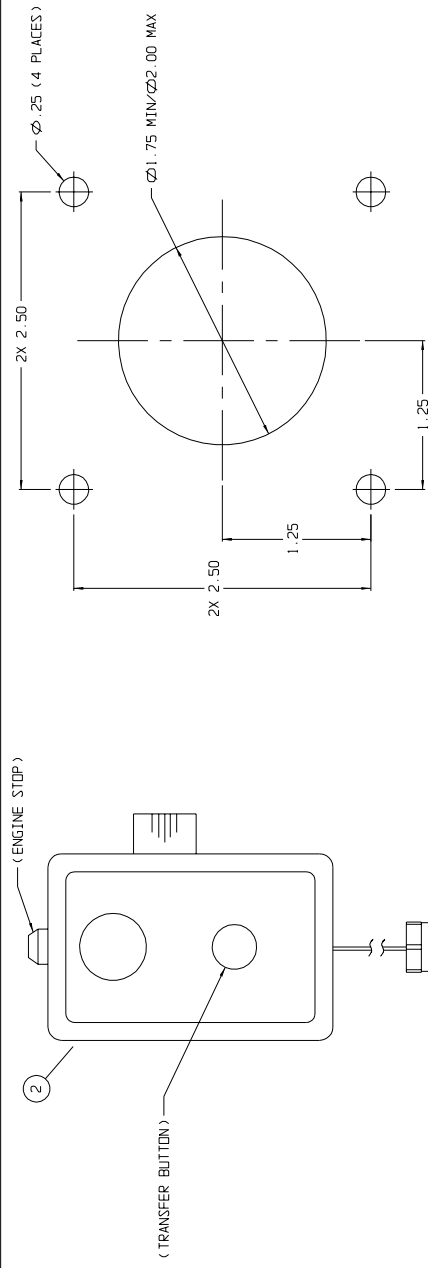
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HANDHELD REMOTE

(SINGLE SCREW)

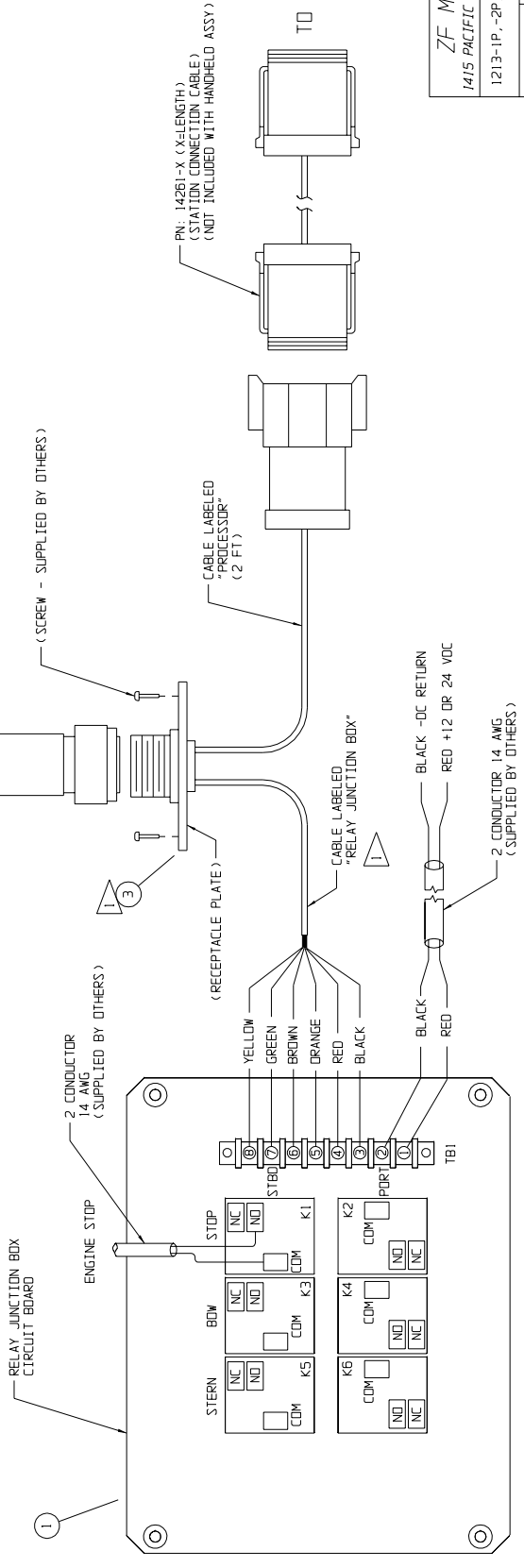
1213-1P, 2P & 3P CONSIST OF:

ITEM#	PART#	DESCRIPTION
1	12984	RELAY JUNCTION BOX
2	12978	HANDHELD REMOTE W/ PLUG AND 25' OF CABLE.
3	RECEPTACLE KIT W/ PLUGS.	

1 1213-1P USES MS12631-50P (50') RECEPTACLE KIT W/ PLUGS.
1213-2P USES MS12631-50P (50') RECEPTACLE KIT W/ PLUGS.
1213-3P USES MS12631-150P (150') RECEPTACLE KIT W/ PLUGS.



RECEPTACLE PLATE
MOUNTING DIMENSIONS
SCALE: 1/1



Z.F. MATHERS, LLC	
1415 PACIFIC DRIVE BURLINGTON WA. 98233	
1213-1P, -2P, -3P INSTALLATION DRAWING	
TOLERANCES:	ENG. J.H.C. DWN. M.WILSON
FRACTION: 1/64"	CHKD. DATE 3-21-02
DECIMAL: 0.005"	SCALE: NONE
UNLESS NOTED	SHT. 1 OF 1
	SIZE B
PART NO. 1213-1P, 2P, 3P	DWG. NO. 11901

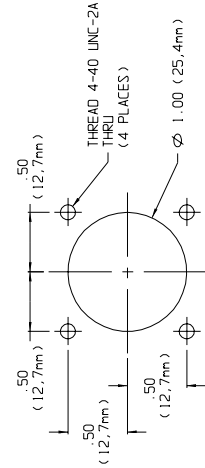
Drawing 11439B No Thrusters - Twin Screw [PN: 1214-1, -2, -3]

PN: 1214-1, 2, 3
HANDHELD REMOTE
(TWIN SCREW)

1214-1, 2 & 3 CONSIST OF:

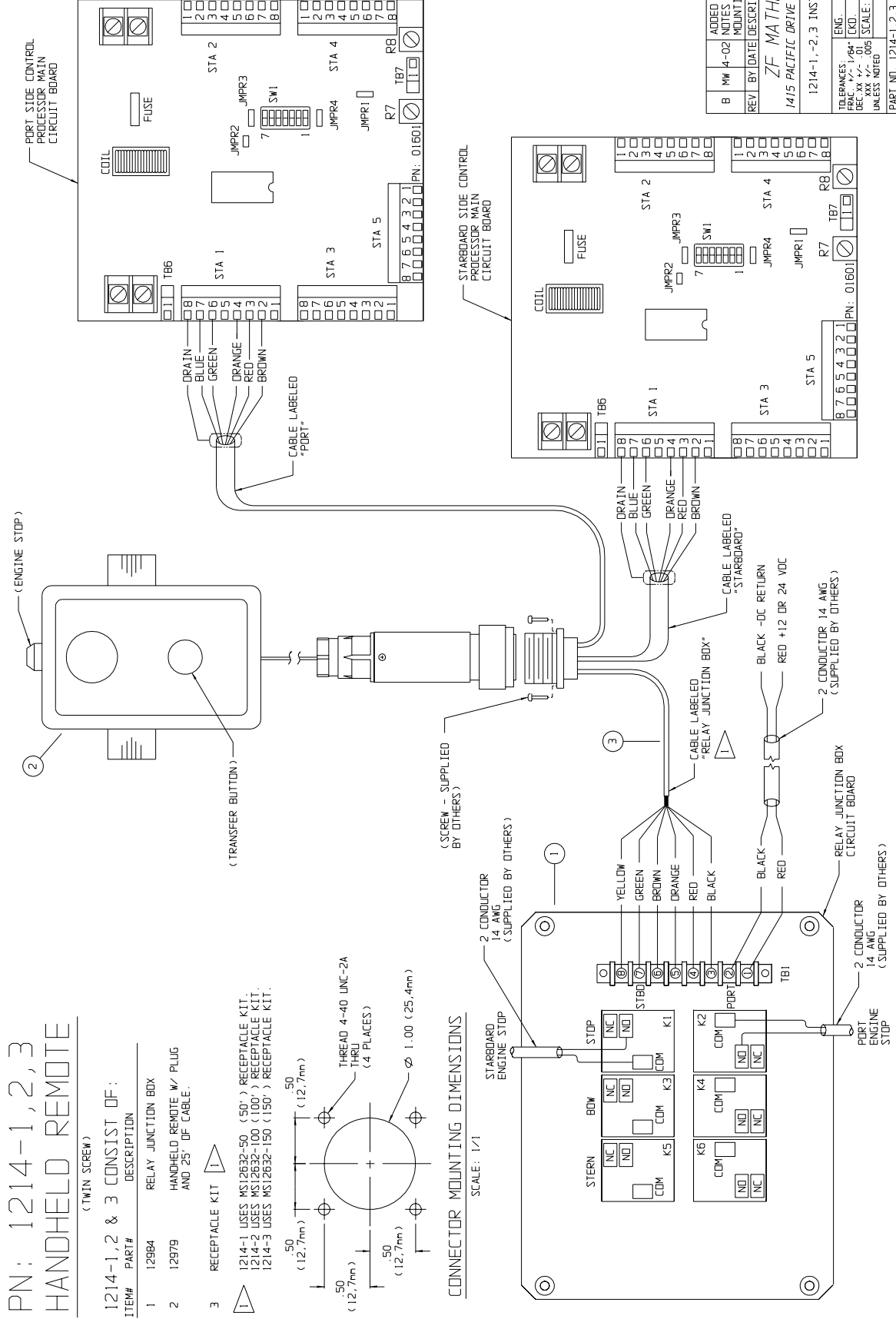
ITEM#	PART#	DESCRIPTION
1	12984	RELAY JUNCTION BOX
2	12979	HANDHELD REMOTE w/ PLUG AND 25' OF CABLE.
3		RECEPTACLE KIT

1214-1 USES MSI2632-50 (50') RECEPTACLE KIT.
1214-2 USES MSI2632-100 (100') RECEPTACLE KIT.
1214-3 USES MSI2632-150 (150') RECEPTACLE KIT.



CONNECTOR MOUNTING DIMENSIONS

SCALE: 1/1



B	MM	4-02	ADDED DRAWING FORMAT, MOUNTING DIMENSIONS.	JC
REV	BY	DATE	DESCRIPTION	CHKD
ZF MATHERS, LLC				
1415 PACIFIC DRIVE BURLINGTON WA - 98233				
1214-1, -2, 3 INSTALLATION DRAWING				
TOLERANCES:	ENG:	DWN:	M. WILSON	
DEC XX +/- .01	CKD:	DATE:	3-26-02	
XXX +/- .05	SCALE:	SHT:	1 OF 1	
UNLESS NOTED	SIZE:	B		
PART NO.:	1214-1, 2, 3	DWG. NO.:	11439	

Drawing 11898 No Thrusters - Twin Screw [PN: 1214-1P, -2P, -3P]

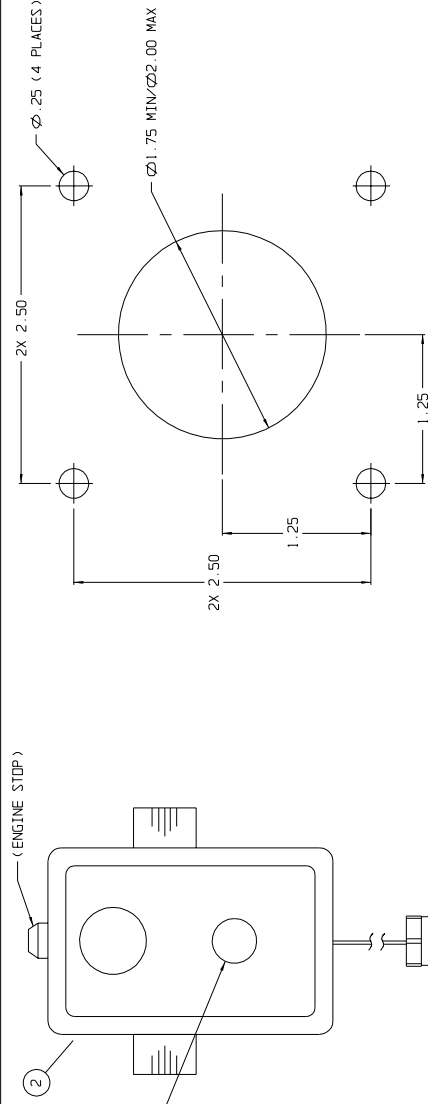
PN: 1214-1P, 2P, 3P
HANDHELD REMOTE

(TWIN SCREW)

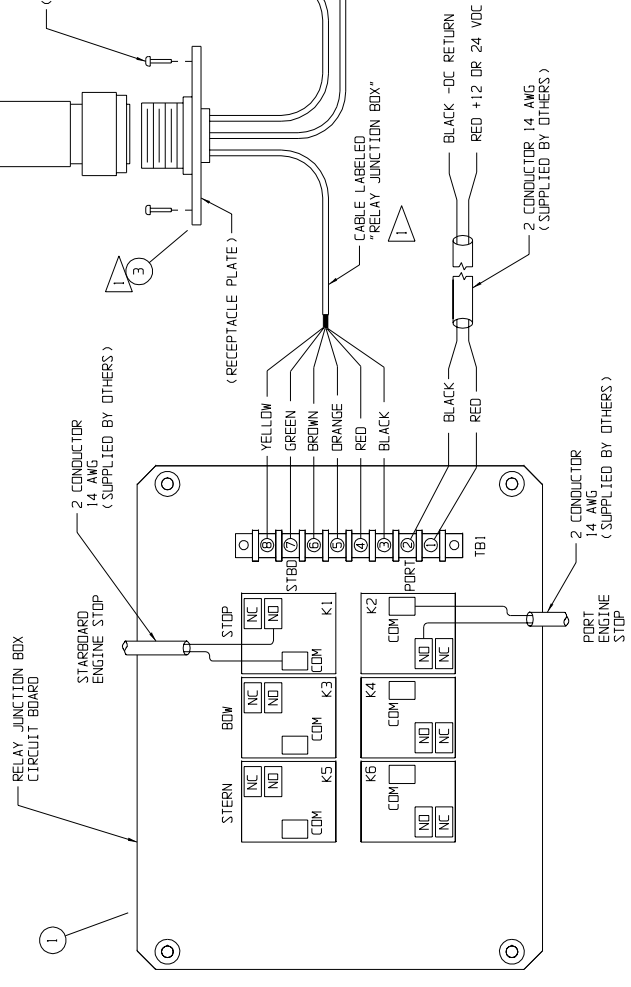
1214-1P, 2P & 3P CONSIST OF:

ITEM#	PART#	DESCRIPTION
1	12984	RELAY JUNCTION BOX
2	12979	HANDHELD REMOTE W/ PLUG AND 25' OF CABLE.
3	RECEPTACLE KIT W/ PLUGS.	

1 1214-1P USES MS12632-50P (50') RECEPTACLE KIT W/ PLUGS.
1214-2P USES MS12632-100P (100') RECEPTACLE KIT W/ PLUGS.
1214-3P USES MS12632-150P (150') RECEPTACLE KIT W/ PLUGS.



RECEPTACLE PLATE
MOUNTING DIMENSIONS
SCALE: 1/1



ZF MATHERS, LLC
1415 PACIFIC DRIVE BURLINGTON WA. 98233

1214-1P, -2P, -3P INSTALLATION DRAWING

ENG. J.H.C.	DWN. M.WILSON
FRAC. 1/2" = 1/64"	DATE 3-21-02
DEC. XX 1/2" = .005	SHT. 1 OF 1
UNLESS NOTED	SCALE: NONE
	SIZE: B
PART NO. 1214-1P, 2P, 3P	DWG. NO. 11898

Drawing 11900 One Thruster - Single Screw [PN: 1443-1P, -2P, -3P]

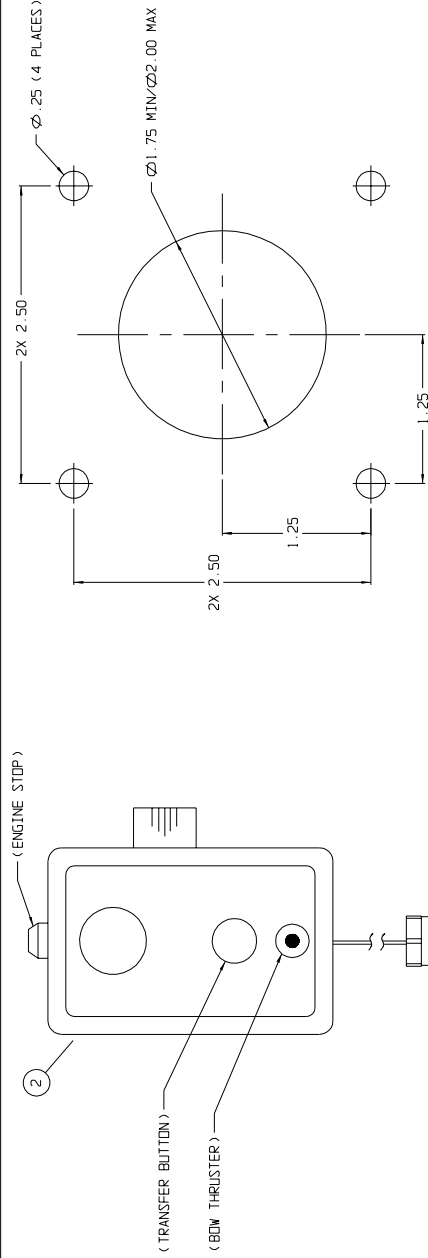
PN: 1443-1P, 2P, 3P
HANDHELD REMOTE

(SINGLE SCREW WITH BOW THRUSTER)

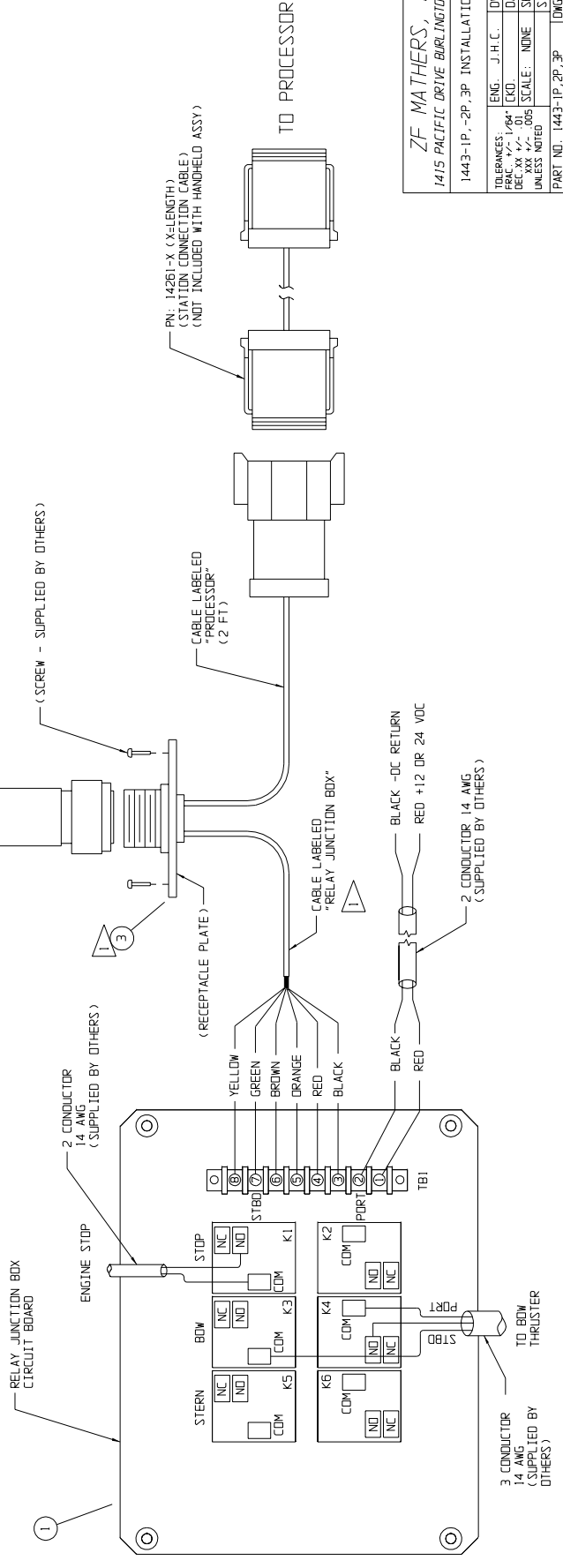
1443-1P, 2P & 3P CONSIST OF:

ITEM#	PART#	DESCRIPTION
1	12984	RELAY JUNCTION BOX
2	12980	HANDHELD REMOTE W/ PLUG AND 25' OF CABLE.
3	RECEPTACLE KIT W/ PLUGS.	

1 RECEPTACLE KIT W/ PLUGS. (50')
 1443-2P USES WS12631-50P (50') RECEPTACLE KIT W/ PLUGS.
 1443-3P USES WS12631-100P (100') RECEPTACLE KIT W/ PLUGS.
 1443-3P USES WS12631-150P (150') RECEPTACLE KIT W/ PLUGS.



RECEPTACLE PLATE
MOUNTING DIMENSIONS
SCALE: 1/1



ZF MATHERS, LLC
 1415 PACIFIC DRIVE BURLINGTON WA. 98233
 1443-1P, -2P, -3P INSTALLATION DRAWING
 ENG. J.H.C. DWN. M.WILSON
 FRAC. 1/8" CKD. DATE 3-21-02
 DEC. XX 1/8" 005 SCALE: NONE SH. 1 OF 1
 UNLESS NOTED SIZE B
 PART NO. 1443-1P, 2P, 3P DWG. NO. 11900

Drawing 11438B One Thruster - Twin Screw [PN: 1251-1, -2, -3]

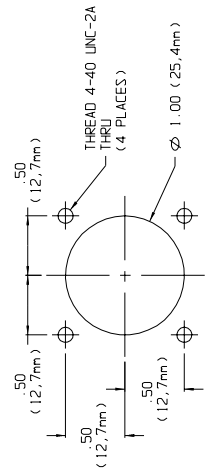
PN: 1251-1, 2, 3
HANDHELD REMOTE

(TWIN SCREW WITH BOW THRUSTER)

1251-1, 2 & 3 CONSIST OF:

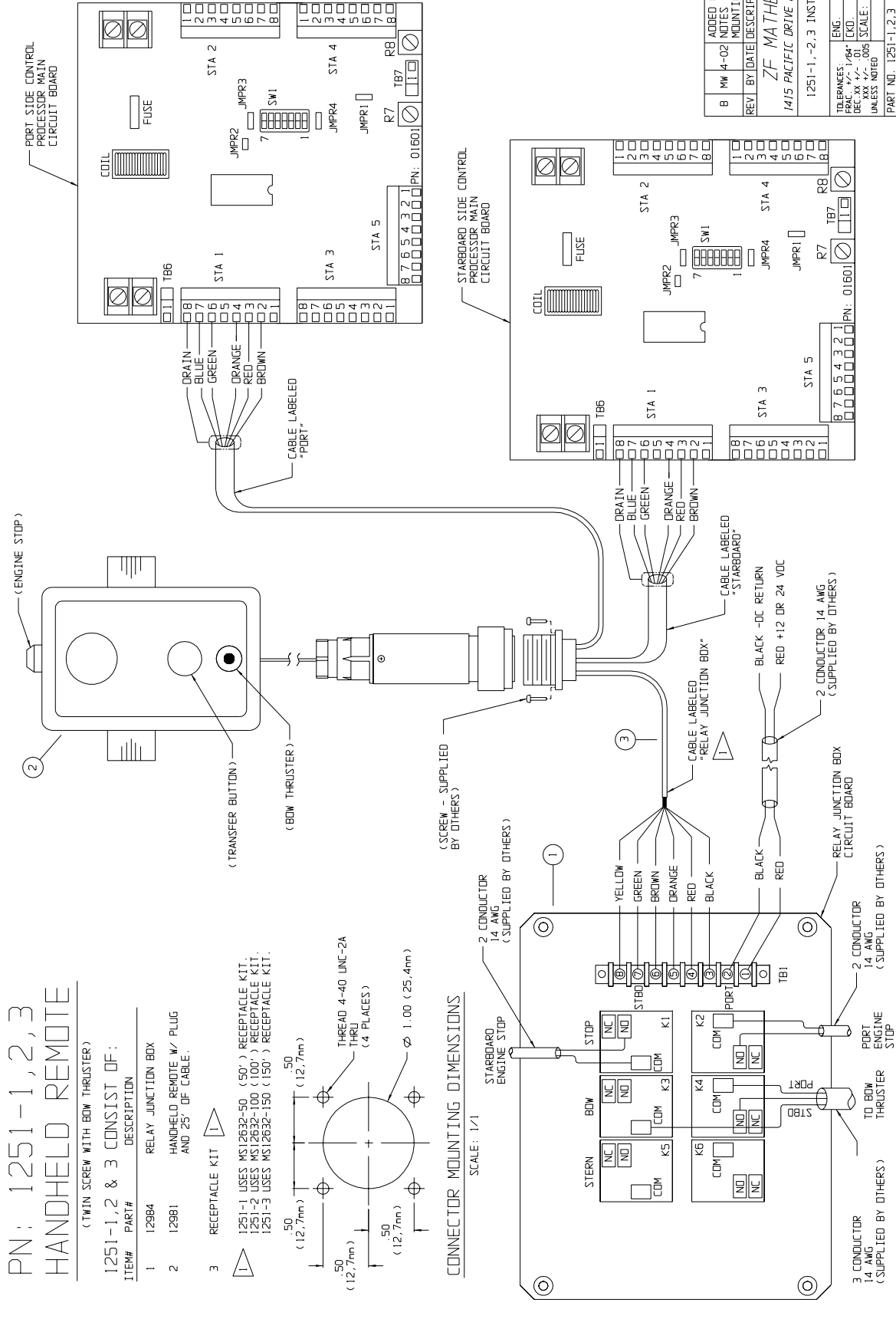
ITEM#	PART#	DESCRIPTION
1	12984	RELAY JUNCTION BOX
2	12981	HANDHELD REMOTE W/ PLUG AND 25' OF CABLE.
3	RECEPTACLE KIT	

- 1251-1 USES MSI2632-50 (.50") RECEPTACLE KIT.
- 1251-2 USES MSI2632-100 (.100") RECEPTACLE KIT.
- 1251-3 USES MSI2632-150 (.150") RECEPTACLE KIT.



CONNECTOR MOUNTING DIMENSIONS

SCALE: 1/1



REV	BY	DATE	DESCRIPTION	CHKD
B	MM	4-02	ADDED DRAWING FORMAT, NOTES AND CONNECTOR MOUNTING DIMENSIONS.	JC

ZF MATHERS, LLC
 1415 PACIFIC DRIVE BURLINGTON WA - 98233

ENGR	DWN	M.WILSON	
TOLERANCES: .04	DATE	3-26-02	
REF: XX +/- .01	SHT.	1 OF 1	
UNLESS NOTED	SCALE:	NONE	
	SIZE:	B	
PART NO.	1251-1, 2, 3	DWG. NO.	11438

Drawing 11852A One Thruster - Twin Screw [PN: 1251-1P, -2P, -3P]

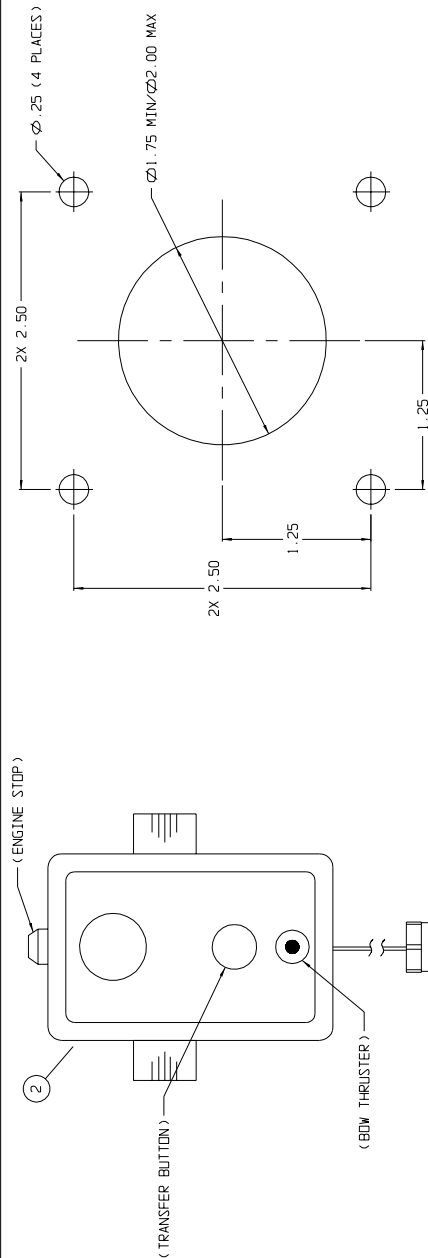
PN: 1251-1P, 2P, 3P
HANDHELD REMOTE

(TWIN SCREW WITH BOW THRUSTER)

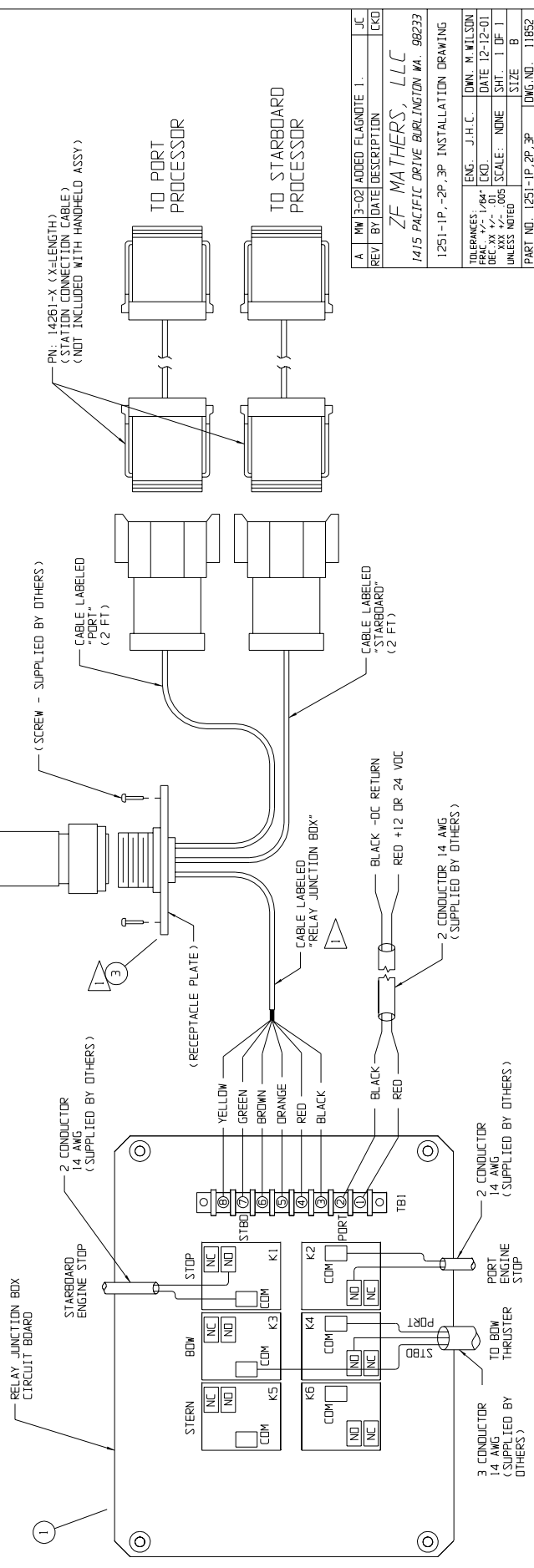
1251-1P, 2P & 3P CONSIST OF:

ITEM#	PART#	DESCRIPTION
1	12984	RELAY JUNCTION BOX
2	12981	HANDHELD REMOTE W/ PLUG AND 25' OF CABLE.
3	RECEPTACLE KIT W/ PLUGS.	

1 RECEPTACLE KIT W/ PLUGS. (50') RECEPTACLE KIT W/ PLUGS.
1251-3P USES WS12632-50P (150') RECEPTACLE KIT W/ PLUGS.
1251-3P USES WS12632-150P (150') RECEPTACLE KIT W/ PLUGS.



RECEPTACLE PLATE
MOUNTING DIMENSIONS
SCALE: 1/1



A	MM 3-02 ADDED FLAGNOTE 1.	JC
REV	BY DATE DESCRIPTION	CKD
ZF MATHERS, LLC		
1415 PACIFIC DRIVE BURLINGTON WA. 98233		
1251-1P, -2P, -3P INSTALLATION DRAWING		
TOLERANCES:	ENG. J.H.C.	DWN. M.WILSON
FRACTIONAL	DEC.	DATE 12-12-01
UNLESS NOTED	SCALE: NONE	SHT. 1 OF 1
	SIZE	B
PART NO.	1251-1P, 2P, 3P	DNW. NO. 11852

Drawing 11440B Bow/Stern Thrusters - Single Screw [PN: 1444-1, -2, -3]

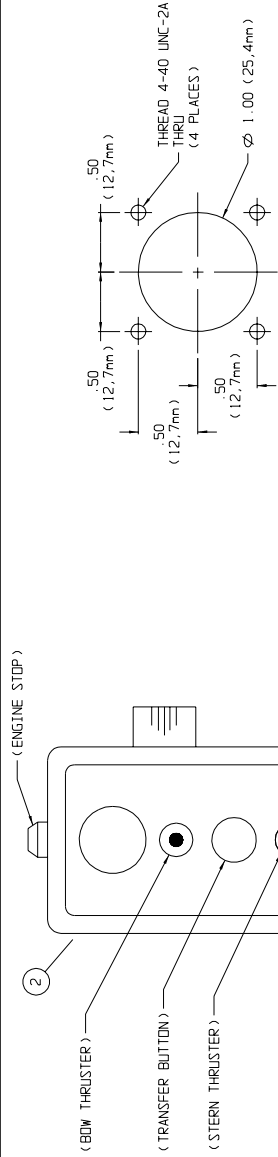
PN: 1444-1, 2, 3
HANDHELD REMOTE

(SINGLE SCREW WITH BOW AND STERN THRUSTER)

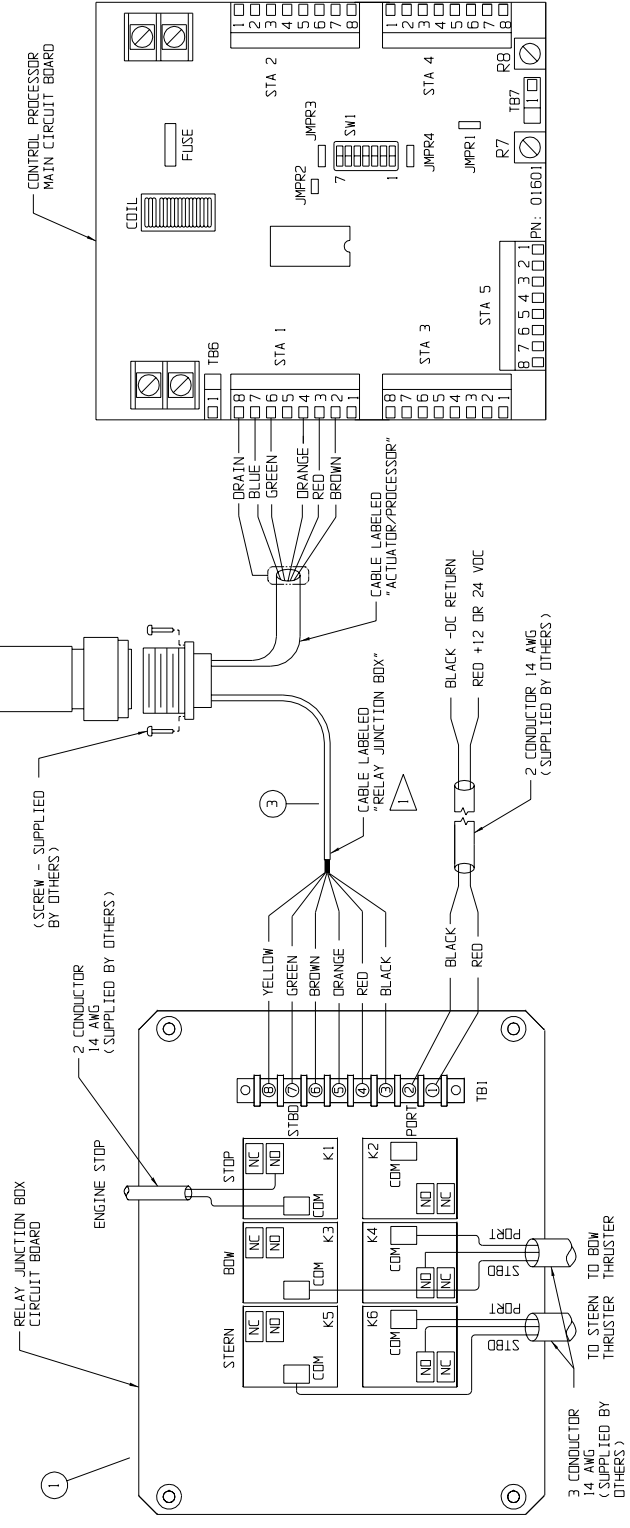
1444-1, 2 & 3 CONSIST OF:

ITEM#	PART#	DESCRIPTION
1	12984	RELAY JUNCTION BOX
2	12982	HANDHELD REMOTE W/ PLUG AND 25' OF CABLE.
3	RECEPTACLE KIT	

1 RECEPTACLE KIT
1444-1 USES MS12631-50 (50') RECEPTACLE KIT.
1444-2 USES MS12631-100 (100') RECEPTACLE KIT.
1444-3 USES MS12631-150 (150') RECEPTACLE KIT.



CONNECTOR MOUNTING DIMENSIONS
SCALE: 1/1



B	MM	4-02	ADDED DRAWING FORMAT, JC MOUNTING DIMENSIONS.
REV	BY	DATE	DESCRIPTION
			CKD
1415 PACIFIC DRIVE BURLINGTON WA - 98233			
1444-1,-2,3 INSTALLATION DRAWING			
Z.E. MATHERS, LLC			
TOLERANCES: .04			
FIN: .005			
DATE: 3-26-02			
SHT: 1 OF 1			
SCALE: NONE			
UNLESS NOTED			
SIZE: B			
PART NO.: 1444-1,2,3			
DWG. NO.: 11440			

Drawing 11899 Bow/Stern Thrusters - Single Screw [PN: 1444-1P, -2P, -3P]

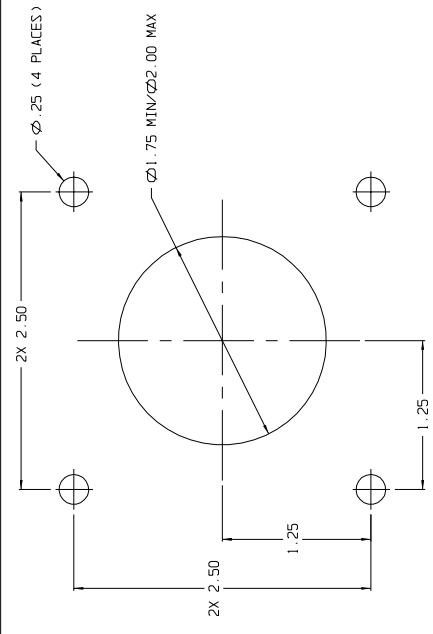
PN: 1444-1P, 2P, 3P
HANDHELD REMOTE

(SINGLE SCREW WITH BOW/STERN THRUSTERS)

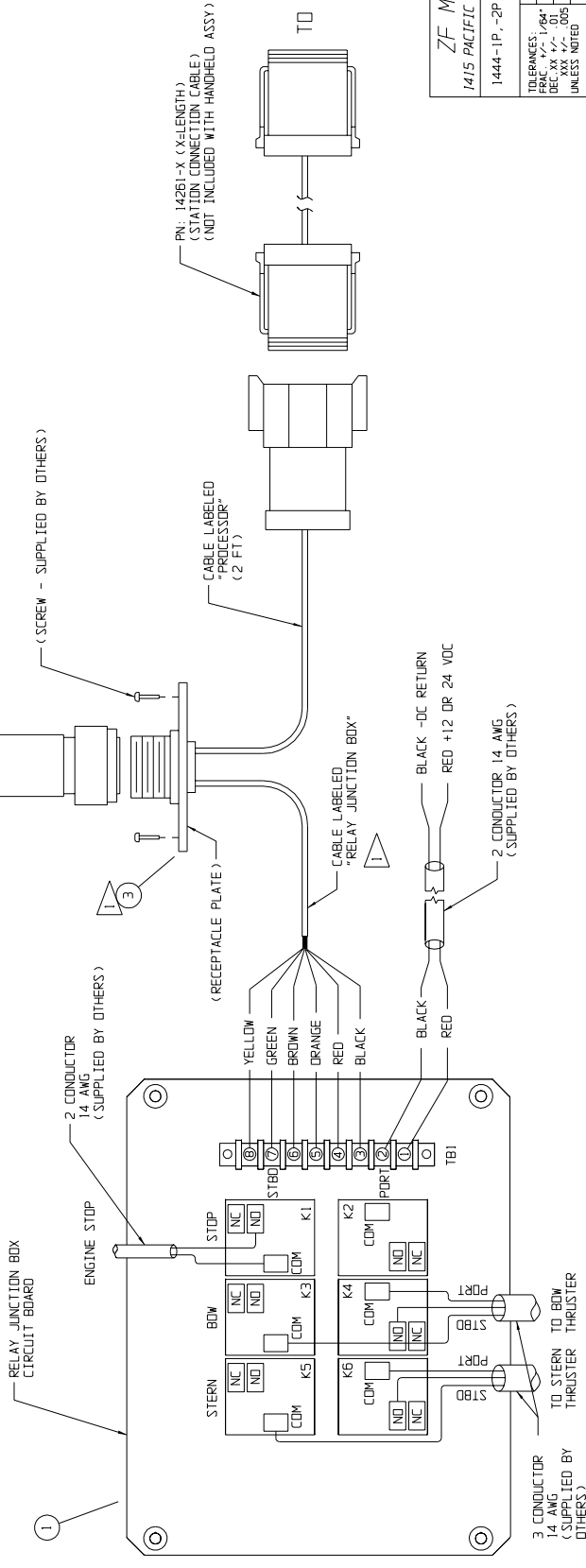
1444-1P, 2P & 3P CONSIST OF:

ITEM#	PART#	DESCRIPTION
1	12984	RELAY JUNCTION BOX
2	12982	HANDHELD REMOTE W/ PLUG AND 25' OF CABLE.
3	RECEPTACLE KIT W/ PLUGS.	

- 1 RECEPTACLE KIT W/ PLUGS. (50')
- 2 RECEPTACLE KIT W/ PLUGS. (100')
- 3 RECEPTACLE KIT W/ PLUGS. (150')



RECEPTACLE PLATE MOUNTING DIMENSIONS
SCALE: 1/1



ZF MATHERS, LLC	
1415 PACIFIC DRIVE BURLINGTON WA. 98233	
1444-1P, -2P, -3P INSTALLATION DRAWING	
ENG. J.H.C.	DWN. M.WILSON
FRAC. 1/2" = 1'-0"	CKD. DATE 3-21-02
DEC. XX 1/2" = 1'-0"	SHT. 1 OF 1
UNLESS NOTED	SCALE: NONE
	SIZE: B
PART NO. 1444-1P, 2P, 3P	DWG. NO. 11899

Drawing 11437B Bow/Stern Thrusters - Twin Screw [PN: 1492-1, -2, -3]

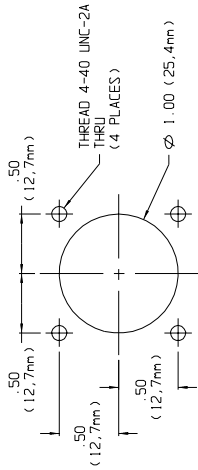
PN: 1492-1, 2, 3
HANDHELD REMOTE

(TWIN SCREW WITH BOW AND STERN THRUSTER)

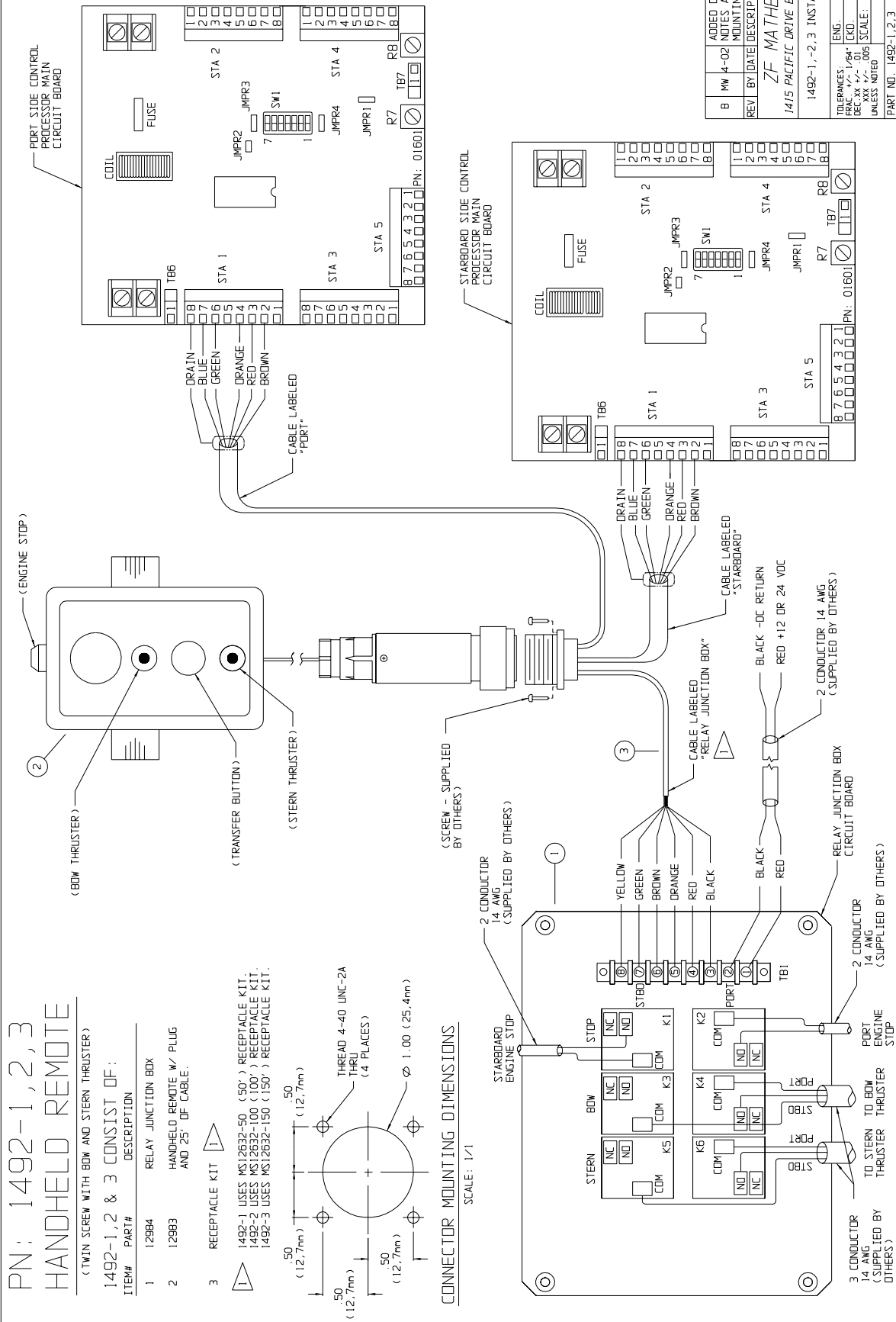
1492-1, 2 & 3 CONSIST OF:

ITEM#	PART#	DESCRIPTION
1	12984	RELAY JUNCTION BOX
2	12983	HANDHELD REMOTE W/ PLUG AND 25' OF CABLE.
3	RECEPTACLE KIT	

- 1 RECEPTACLE KIT
 - 1492-1 USES MST2632-50 (.50") RECEPTACLE KIT.
 - 1492-2 USES MST2632-100 (.100") RECEPTACLE KIT.
 - 1492-3 USES MST2632-150 (.150") RECEPTACLE KIT.



CONNECTOR MOUNTING DIMENSIONS
SCALE: 1/1



REV	BY	DATE	DESCRIPTION	CHKD
B	MM	4-02	ADDED DRAWING FORMAT, NOTES AND CONNECTOR MOUNTING DIMENSIONS.	JC
Z.F. MATHERS, LLC 1415 PACIFIC DRIVE BURLINGTON MA - 08233				
1492-1, -2, 3 INSTALLATION DRAWING				
TOLERANCES:		ENG:	DWN: M. WILSON	
FRACTIONAL:		CKD:	DATE: 3-26-02	
DECIMAL:		REF:	SHT: 1 OF 1	
UNLESS NOTED		SCALE:	NONE	
		SIZE:	B	
PART NO.:		1492-1, 2, 3	DWG. NO.:	
			11437	

Drawing 11896 Bow/Stern Thrusters - Twin Screw [PN: 1492-1P, -2P, -3P]

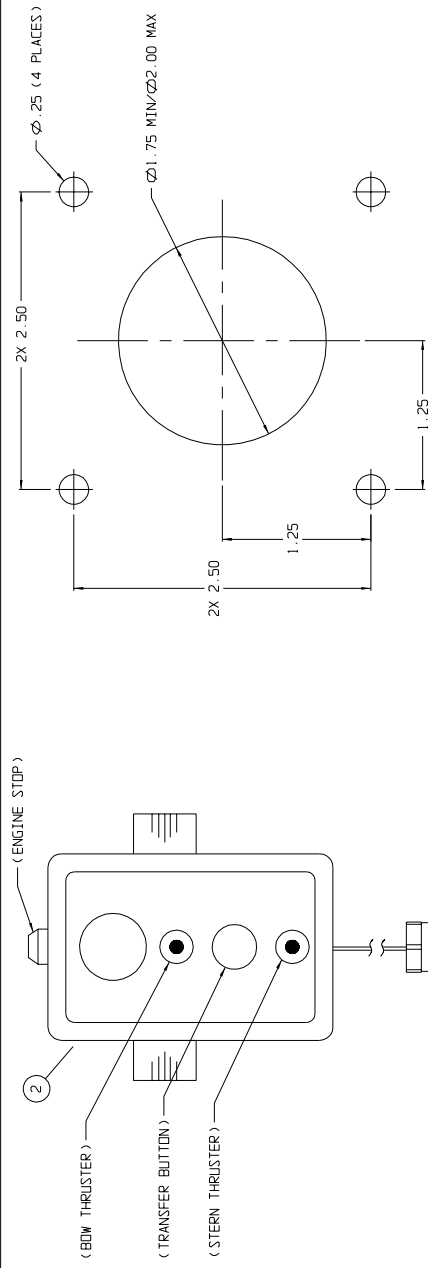
PN: 1492-1P, 2P, 3P
HANDHELD REMOTE

(TWIN SCREW WITH BOW/STERN THRUSTERS)

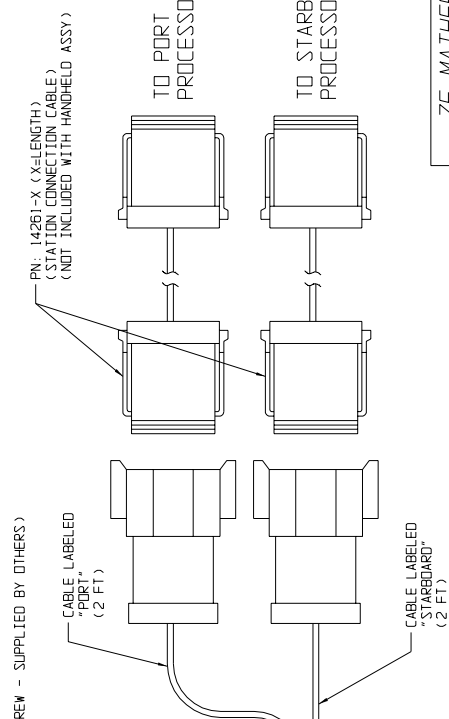
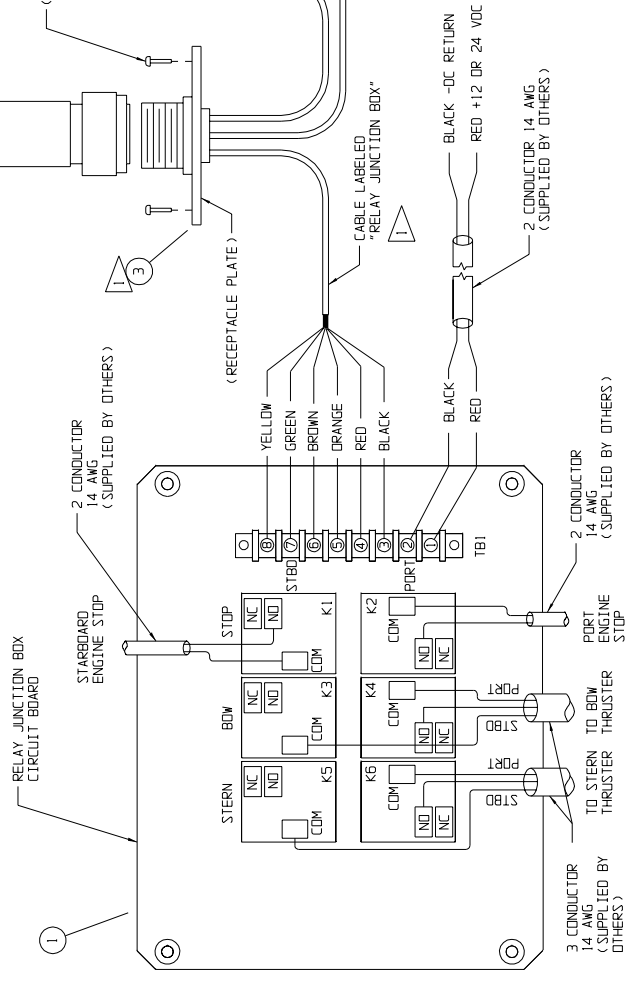
1492-1P, 2P & 3P CONSIST OF:

ITEM#	PART#	DESCRIPTION
1	12984	RELAY JUNCTION BOX
2	12983	HANDHELD REMOTE W/ PLUG AND 25' OF CABLE.
3	RECEPTACLE KIT W/ PLUGS.	

1 RECEPTACLE KIT W/ PLUGS. (50')
 1492-1P USES WS12632-50P (50') RECEPTACLE KIT W/ PLUGS.
 1492-2P USES WS12632-100P (100') RECEPTACLE KIT W/ PLUGS.
 1492-3P USES WS12632-150P (150') RECEPTACLE KIT W/ PLUGS.



RECEPTACLE PLATE
MOUNTING DIMENSIONS
SCALE: 1/1



ZF MATHERS, LLC
1415 PACIFIC DRIVE BURLINGTON WA. 98233

1492-1P, -2P, -3P INSTALLATION DRAWING

ENG. J.H.C.	DWN. M.WILSON
FRAC. 1/4" = 1/64"	DATE 3-21-02
DEC. XX 1/16"	SHT. 1 OF 1
UNLESS NOTED	SCALE: NONE
	SIZE: B
	PART NO. 1492-1P, 2P, 3P
	DWG. NO. 11896

