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# Hand Held Installation Manual



MicroCommander/ClearCommand

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## 1. THEORY OF OPERATION

The Hand Held Remote Control System (hereafter referred to as Hand Held System) is offered as an accessory for most MicroCommander or ClearCommand Propulsion Control Systems. The Hand Held System is utilized as a secondary station, while the primary station is generally a fixed bridge station.

### 1.1 FEATURES

Hand Held Systems offers:

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

Optional:

- Thruster Control
- Stainless steel mounting bracket
- Cable Extension – 25 feet (7,62m)
- Additional Receptacles
- Receptacle Protector
- Additional Hand Held Units
- Additional Safety Lanyards

Mathers Controls offers several different configurations of Hand Held Systems to apply for special needs. Refer to Table 1 for a list of configurations.

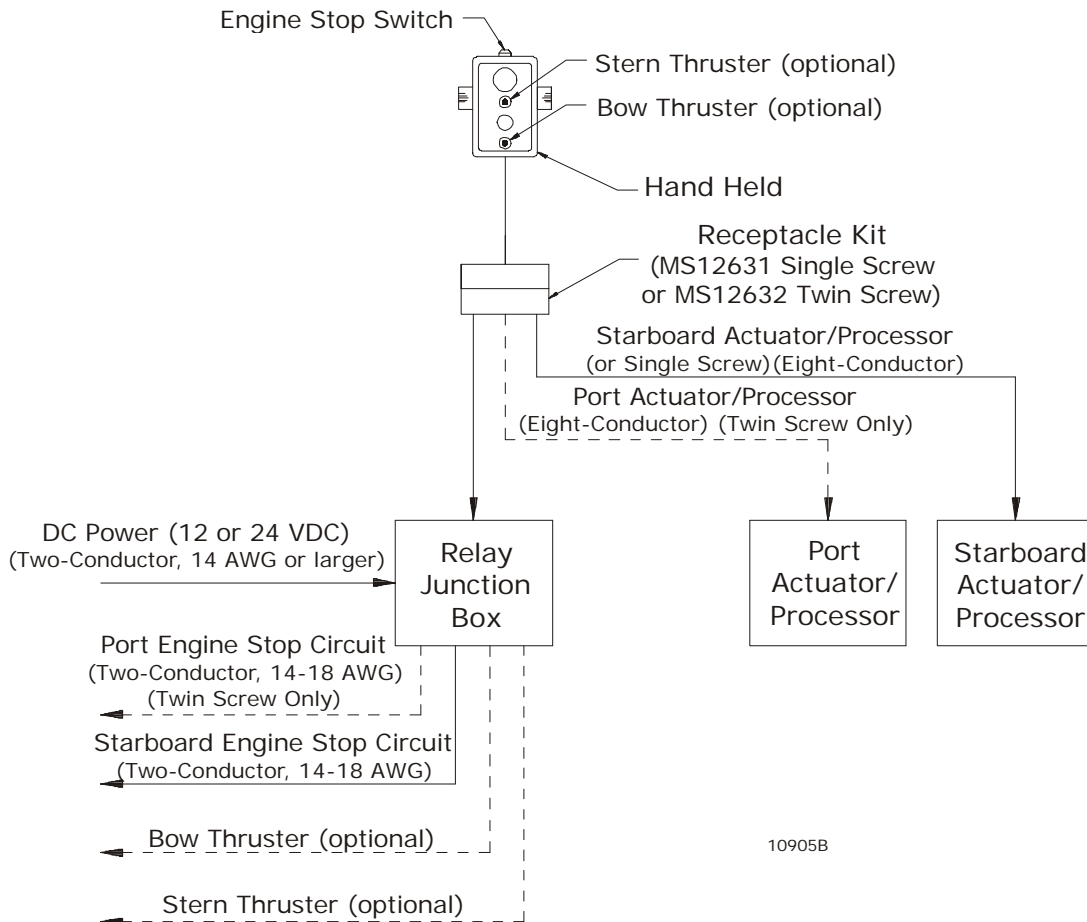
**Table 1 – Hand Held Systems**

**Mathers Part Number**

<b>Hand Held Systems</b>	<b>Single Screw</b>	<b>Cable Length in Feet</b>	<b>Twin Screw</b>
Main Engine Control Only	1213-1	50'	1214-1
	1213-2	100'	1214-2
	1213-3	150'	1214-3
Main Engine Control & One Thruster Control (Bow Thruster)	1443-1	50'	1251-1
	1443-2	100'	1251-2
	1443-3	150'	1251-3
Main Engine Control and Two Thruster Control (Bow & Stern or Bow & Bow)	1444-1	50'	1492-1
	1444-2	100'	1492-2
	1444-3	150'	1492-3

## 1.2 TYPICAL CABLING

Refer to Figure 1.



**Figure 1 – Typical Cabling Diagram**

The Hand Held connects to a plug Receptacle. This Receptacle is pre-wired with cables labeled for connection to the following:

- Existing MicroCommander Actuators or ClearCommand Control Processors (hereafter referred to as Actuator/Processor)
- Relay Junction Box.

The Relay Junction Box is to be wired to:

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

### 1.3 SAFETY LANYARD

The Hand Held Unit is equipped with a Safety Lanyard with locking key. Refer to Figure 2.

The lanyard is to be worn around the operator's wrist during Hand Held 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

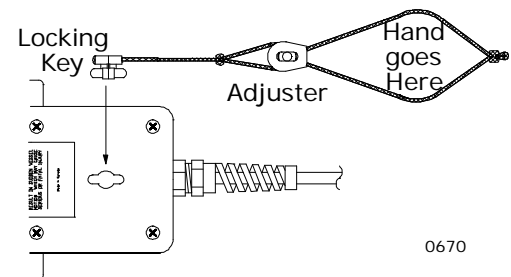
The Hand Held Station may not regain command until:

- The key has been reinstalled in the socket and;
- The control knobs are in the vertical position. (Refer to Figure 3)

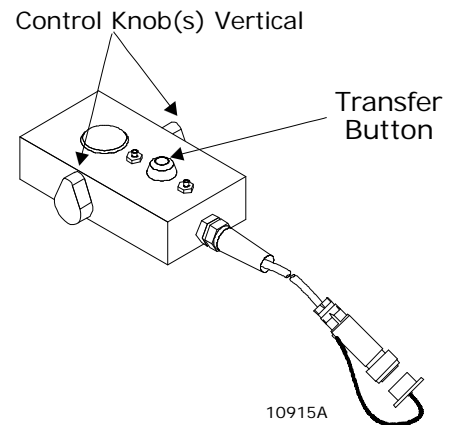
Additional Lanyards are available, see 9.6 Parts Source for ordering information.

### 1.4 ENGINE STOP SWITCH

The Hand Held is supplied with an Engine Stop Switch. The switch is located at the top of the Hand Held. Refer to Figure 1.



**Figure 2 – Safety Lanyard**



**Figure 3 – Taking Command at the Hand Held**

The Engine Stop Switch is ALWAYS operable when DC power is On to the Hand Held System.

The Hand Held System does not need to be in command of the Actuator/Processor, or have the Safety Lanyard attached, to stop engines.

**WARNING:** Each remote station must have some method to stop the engine. Connection of the Hand Held Stop Switch to the engine(s) stop circuits is mandatory. Warranty canceled if requirement not followed.

### **1.5 THRUSTER COMMAND (OPTIONAL)**

Thruster command is ALWAYS operable when DC power is On to the Hand Held System.

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

## **2. OPERATOR INSTRUCTIONS**

### **2.1 SINGLE OR TWIN SCREW HAND HELD MAIN ENGINE COMMAND**

Reference Figure 3.

To transfer command to the Hand Held:

- A) Place the control knob(s) in the vertical position
- B) Depress the Station Transfer Button.

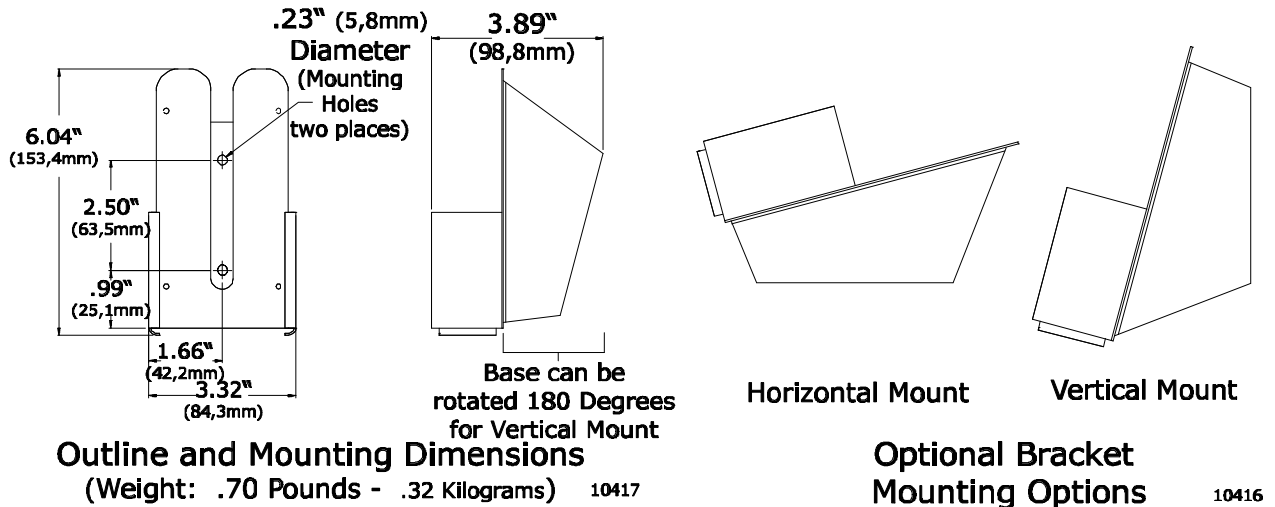
A red indicator light next to the control knob(s) will be lit when the Hand Held is in command.

**NOTE:** On Twin Screw applications both Port and Starboard indicator light on the Hand Held Unit must be lit.

The Hand Held may be used:

- Secured in a holding bracket (refer to Figure 4)





**Figure 4 – Optional Bracket Mounting**

- Held freely in your hand while secured to the operator's wrist by the safety lanyard

**CAUTION:** Only while on the vessel operate the Hand Held. A person standing on the dock or another vessel should never operate it. When using the Hand Held the operators should brace themselves against any change in vessel motion.

When the Hand Held is not in use it should be placed within a holding bracket. Refer to 9.6 Parts Source for ordering information.

If a Hand Held is to be moved to another Receptacle location:

- Take command at a different remote station.
- Unplug Hand Held and seal Receptacle with Protective Cap.
- Move to another Receptacle and remove Receptacle Protective Cap.
- Plug Hand Held into the new Receptacle.
- Take command at the Hand Held.

## **2.2 THRUSTER CONTROL (OPTIONAL)**

When one Thruster is used:

- The Thruster switch is located just below the Station Transfer Button on the Hand Held. (Reference Figure 1)

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

The Thruster switch is spring centered to the OFF position.

**By pressing and holding the switch Port or Starboard**, the Hand Held 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 Hand Held Unit. The Hand Held 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.

## **3. REQUIRED PARTS AND TOOLS**

### **3.1 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. (Included in Receptacle Kit)

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

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

### 3.2 TOOLS REQUIRED FOR INSTALLATION

Anti-static Wrist Strap

Wire cutter (Recommend Thomas & Betts WT-2000)

Wire stripper (Recommend Thomas & Betts WT-2000)

Wire crimper (Recommend Thomas & Betts WT-2000)

Screwdriver – medium Phillips #2

Screwdriver – medium straight slot

Screwdriver – small straight slot

Hole saw – 1 inch (25,4mm)

Drills – 9/32 inch (7,2mm) and 7/32 inch (5,6mm)

### 3.3 HAND HELD REMOTE CONTROL

**Included are:**

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

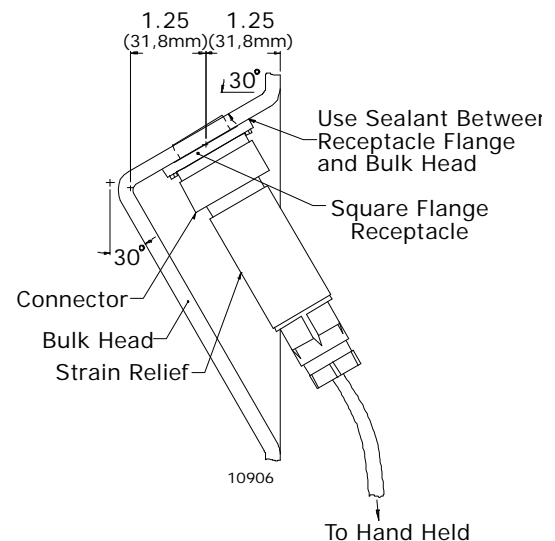
**Optional extras:**

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

## 4. PLAN THE INSTALLATION

### 4.1 RECEPTACLE LOCATION

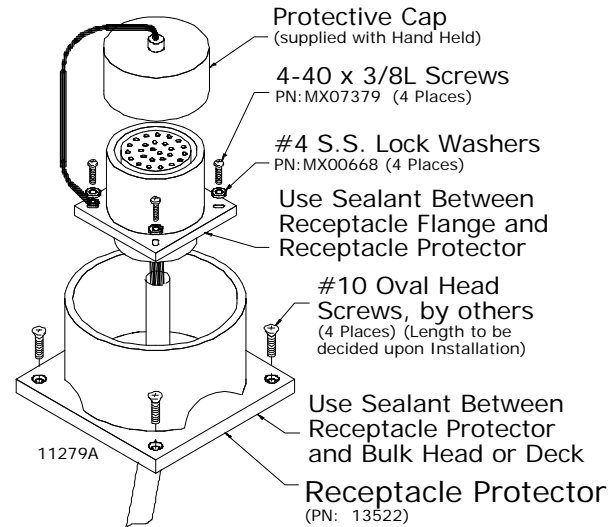
Refer to Figure 5



**Figure 5 – Suggested Mounting**

### 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 8)
- Use the supplied protective cap and lanyard when Receptacle is not in use by the Hand Held Unit.
- 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 6 and Figure 9.



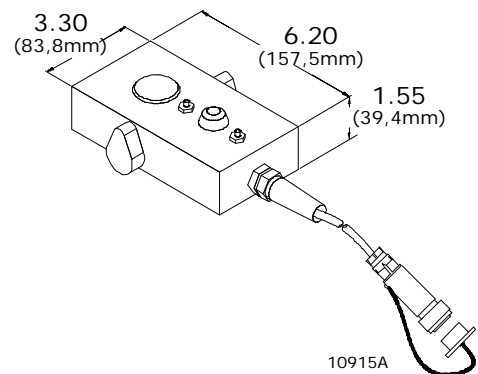
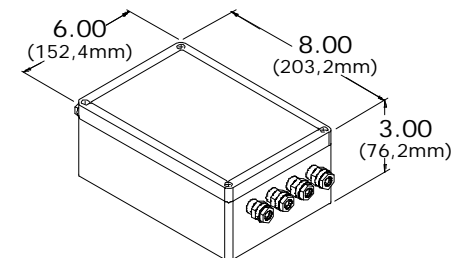
**Figure 6 – Receptacle Protector**

## 4.2 RELAY JUNCTION BOX LOCATION

Reference Figure 7.

### Considerations:

- The Relay Junction Box is water resistant, but should be mounted in a dry location.
- Mount in any attitude easily accessible for electric



**Figure 7 – Dimensions**

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.

### **4.3 ENGINE STOP SWITCH**

It is a requirement of Mathers Controls that Engine Stop Switches are available at all remote stations. The Hand Held 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 Hand Held.

**WARNING:** Each remote station must have some method to stop the engine. Warranty canceled if requirement not followed.

### **4.4 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.

## **5. INSTALLATION**

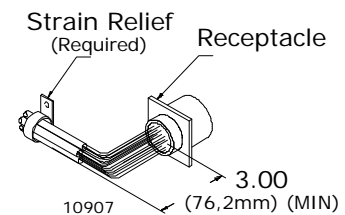
**CAUTION:** Static electricity can destroy electronic components. Anytime the Actuator/Processor cover is off, use an anti-static wrist strap and connect it to the Actuator/Processor frame. This will drain any static charge you may have on your person.

**NOTE:** Refer to the Technical Manual supplied with your MicroCommander or ClearCommand Control System for reference when connecting the Hand Held System to your current control system.

## 5.1 RECEPTACLE

### 5.1.1 RECEPTACLE PROTECTOR (NOT USED)

- A) At the location decided to house the Receptacle, cut a .975 (24,8mm) diameter hole through the bulkhead.
- 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 lanyard. (Protective cap and lanyard supplied with Receptacle Kit)
- F) From the inside, secure the cable for strain relief. Strain relief is to be supplied by the installer. Refer to Figure 8.
- G) Once strain relief is complete, run the electrical cable as labeled.



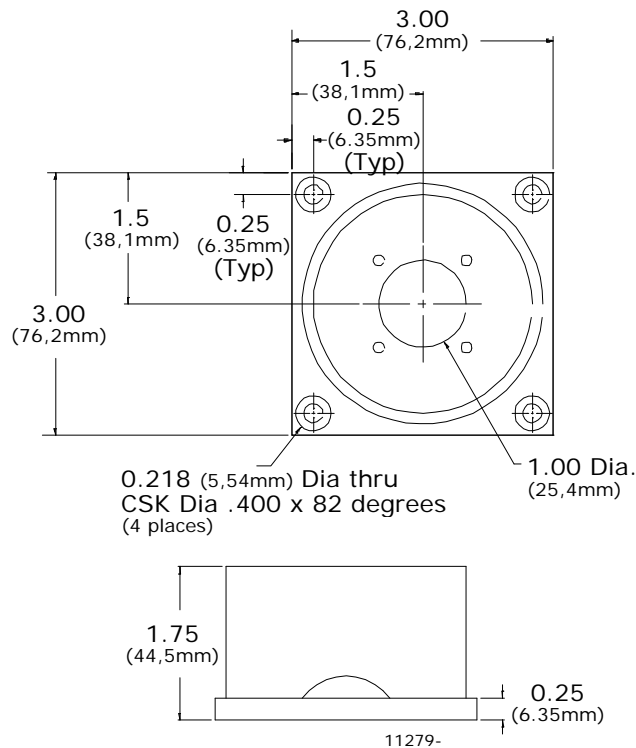
**Figure 8 – Strain Relief**

**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:** Additional Receptacles are available. (Refer to 9.6 Parts Source)

**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.

### 5.1.2 RECEPTACLE PROTECTOR (USED)



**Figure 9 – Receptacle Protector Dimensions**

- A) At the location decided to house the Receptacle, cut a center hole through the bulkhead and drill four mounting screw holes. Refer to Figure 9 for Receptacle Protector dimensions.
- B) Place sealant around the bulkhead hole.
- C) Place Receptacle Protector over the bulkhead hole so cable may be fed through the center hole of the bulkhead and the Protector.
- D) Secure Protector to bulkhead with 4 screws.
- E) Feed Receptacle cable through the Protector and the bulkhead.
- F) Place sealant around the center hole of the Protector.
- G) Place Receptacle into the bulkhead hole.
- H) Secure with 4 screws. Use one of these screws to secure the protective cap's lanyard. (Protective cap and lanyard supplied with Receptacle Kit)
- I) From the inside, secure the cable for strain relief. Strain relief is to be supplied by the installer. Refer to Figure 8.
- J) Once strain relief is complete, run the electrical cable as labeled.

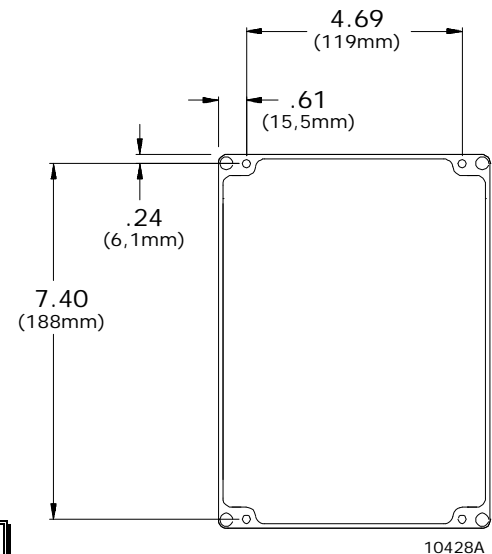
**CAUTION:** When installing the cable, support the cables using clamps or straps not more than 18 inches (0,5m) apart, unless contained in a conduit. Install each cable so it is protected from physical damage. Ensure cable is not under stress or strain at the Receptacle.

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

## 5.2 RELAY JUNCTION BOX

### 5.2.1 RELAY JUNCTION BOX INSTALLATION

- A) Remove the Relay Junction Box cover.
- B) Mount the Relay Junction Box with 4 screws (included with Relay Junction Box). Refer to Figure 10.



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

**Figure 10 – Relay Junction Box Mounting Dimensions**

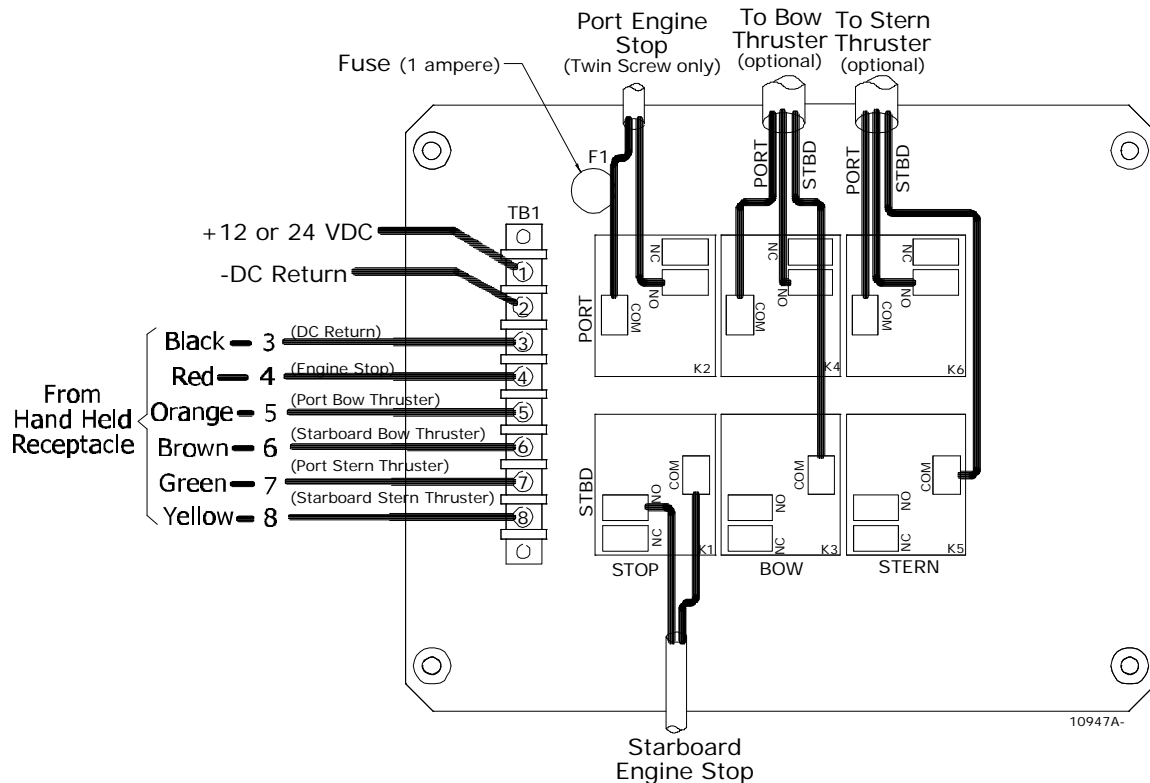
### 5.2.2 RECEPTACLE CABLE INSTALLATION TO RELAY JUNCTION BOX

**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.

- A) Run the cable labeled RELAY JUNCTION BOX through a watertight connector supplied on the Relay Junction Box.
- B) Strip the black, red, orange, brown, green, and yellow wires 3/8-inch (9,5mm).



- C) Install red fork crimp terminals included with Relay Junction Box. (Thomas & Betts PNF18-6SLF or equal)
- D) Make cable connections as indicated on Figure 11.



**Figure 11 – Wiring Diagram**

### 5.2.3 POWER CABLE INSTALLATION

**WARNING:** When connecting the DC power cable 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.

- B) Run the cable through a watertight connector supplied on the Relay Junction Box.
- C) Strip each wire 3/8-inch (9,5mm).
- D) Install blue fork crimp terminals included with Relay Junction Box. (Thomas & Betts PNF14-6SLF or equal)
- E) Connect two-conductor cable as indicated on Figure 11.

### **5.3 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) Run the cables through a watertight connector supplied on the Relay Junction Box.
- C) 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) Connect as indicated in Figure 11.
- F) Refer to the information supplied by your engine dealer for connection to the Engine Stop Circuits.

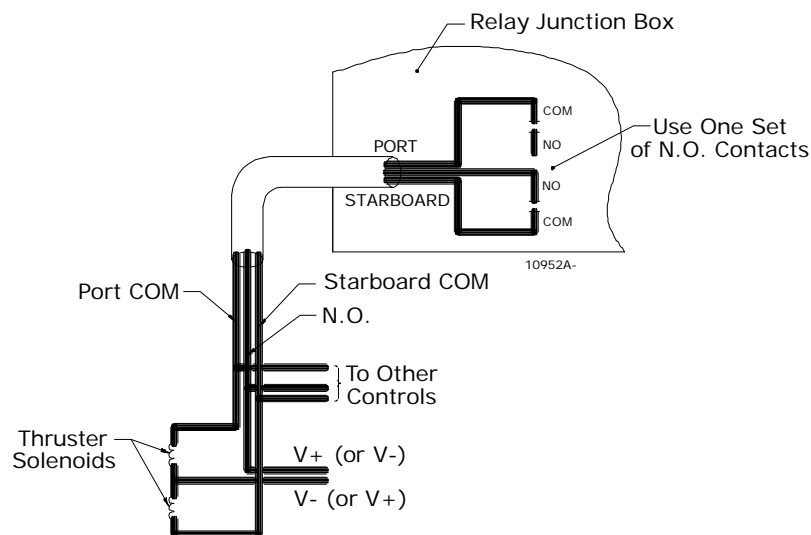
**CAUTION:** The Engine Stop Relays have normally open (maximum 20-ampere) and normally closed (maximum 10-ampere) contacts. The normally open contacts are typically used for fuel shut-off solenoids and should be wired in parallel with any existing fuel shut-off circuits. The normally closed contacts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

## 5.4 THRUSTER CABLE INSTALLATION (OPTIONAL)

- A) 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.

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



**Figure 12 – Typical Thruster Connections**

- C) 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 11.
- F) Make connections at the Thruster. Refer to the information supplied with the Thruster and Figure 12.

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

### **5.5 RECEPTACLE CABLE INSTALLATION TO ACTUATOR/PROCESSOR**

**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. (See original System Manual System Drawing Notes for information regarding cable hole penetration of an Actuator/Processor).
- D) Strip the PVC jacket and shielding back approximately 3 inches (75mm).

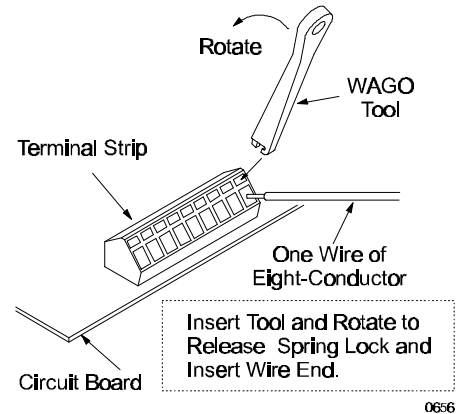
**CAUTION:** Stagger wire lead length to match the Station terminal strip. Wire leads must not touch frame.

**NOTE:** The Hand Held may be connected on any unused Station Terminal strip within the Actuator/Processor. For Twin Screw Applications ensure connection of the Hand Held 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.

- E) Strip the wire 3/8-inch (9,5mm) on each lead.

**NOTE: A WAGO Tool is taped to the relay on the circuit board in each Actuator/Processor.**

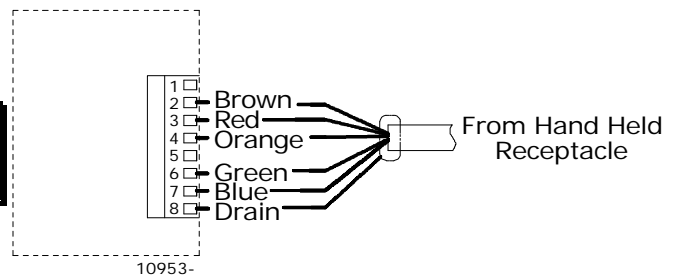
- F) Use a WAGO tool to depress the spring lock for the individual wire connection to the terminal strip. Refer to Figure 13.
- G) Connect colors as shown on Figure 14.
- H) Connect the shielding drain wire (bare wire) to Terminal 8 on the terminal strip.



**Figure 13 – Terminal Connection**

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

- I) Feed through a little slack cable, and tighten the cable grip on the cable.



**Figure 14 – Typical Connections at Actuator/Processor**

## 6. ADJUSTMENTS AND TESTS (SECURED TO DOCK)

### 6.1 HAND HELD UNIT (ENGINES STOPPED)

- A) Turn On power to the Control System
- B) Plug Hand Held into a Receptacle.
- C) Take command at the Hand Held Unit.
- D) Verify command indicator lights are lit.
- E) Move the Hand Held control knob fully one way, then the other.

- F) Verify command is correct.
- G) Refer to your original Control System Manual for further testing of Control Heads

**NOTE: If more than one Receptacle has been installed, do Hand Held Unit testing at EACH Receptacle to ensure Receptacle hook-up is correct.**

## **6.2 ENGINE STOP SWITCHES TEST (ENGINES RUNNING)**

- A) Start engine(s).
- B) Plug Hand Held into a Receptacle.
- C) Verify that the Engine Stop Switch on the Hand Held functions correctly.

**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 Hand Held System. The Hand Held 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. Warranty canceled if requirement of Engine Stop Switches at all remote stations is not installed.**

## **6.3 OPTIONAL THRUSTER SWITCH TEST (ENGINES RUNNING)**

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

- A) Plug Hand Held into a Receptacle.

- 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.**

## **7. ADJUSTMENTS AND TEST (UNDERWAY)**

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

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

There are no adjustments to be made underway.

## **8. MAINTENANCE**

### **8.1 HAND HELD UNIT AND RELAY JUNCTION BOX**

The Hand Held, Receptacle, and Relay Junction Box do not require scheduled maintenance.

## **9. REFERENCES**

### **9.1 AMERICAN BOAT & YACHT COUNCIL**

**(ABYC)**

Box 806

Amityville, NY 11701

E-1 Bonding of Direct Current Systems

E-3 Wiring Identification on Boats

E-9 DC Electrical Systems on Boats

H-2.4e or 32.4g Ambient Temp. 50 degrees C

### **9.2 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

### **9.3 SOCIETY OF AUTOMOTIVE ENGINEERS**

400 Commonwealth Drive  
Warrendale, PA 15096  
J1171 External Ignition Protection  
J1428 Marine Circuit Breakers  
J378 Marine Engine Wiring

### **9.4 NATIONAL MARINE MANUFACTURERS ASSOCIATION**

401 North Michigan Avenue  
Chicago, IL 60611

### **9.5 UNDERWRITERS LABORATORIES**



## 9.6 PARTS SOURCE

### Table 2 – Parts List

Part Name	Mathers Part No.	Mfr & 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:		
<b>SINGLE SCREW</b>		
50 foot cable	MS12631	
100 foot cable	MS13610	
150 foot cable	MS13611	
<b>TWIN SCREW</b>		
50 foot cable	MS12632	
100 foot cable	MS13137	
150 foot cable	MS13355	
Receptacle Protector	13523	
25 Foot (7,62m) Extension Cable	Single Screw MS12935 Twin Screw MS12772	
Bracket Assy, Hand Held	1233	
Safety Lanyard	81237	Comnav Part No. 81237
Hand Holds:		
<b>SINGLE SCREW</b>		
Main Engine Control Only	12978	
Main Engine Control One Thruster	12980	
Main Engine Control Two Thruster	12982	
<b>TWIN SCREW</b>		
Main Engine Control Only	12979	
Main Engine Control One Thruster	12981	
Main Engine Control Two Thruster	12983	
Relay Junction Box	12984	
Technical Manual	MM12822	

