



ISO 9001 CERTIFIED

MANUFACTURING COMPANY LIMITED

8238-129TH Street

Surrey, B.C. Canada V3W 0A6

Telephone: (604) 572-3935

Fax: (604) 590-8313

<http://www.kobelt.com>

MIGHTY MARINER

ENGINE CONTROLS

INSTALLATION INSTRUCTIONS

December 2007

“Leaders in Quality Marine Controls, Steering Gear, and Disc Brakes.”



ELECTRONIC ENGINE CONTROLS INSTALLATION INSTRUCTIONS

Table of Contents

	<u>Page</u>
1. GENERAL INFORMATION.....	5
2. SYSTEM COMPONENTS.....	6
2.1 THE 6527-S ACTUATOR.....	6
2.2 THE 6503 ELECTRONIC CONTROL CARD.....	7
2.3 STATION CONTROL HEADS.....	9
2.4 SYNCHRONIZER INPUT.....	10
2.5 SHAFT BRAKE/NEUTRAL SAFETY SWITCH OUTPUT.....	10
2.6 COMPONENT INFORMATION AND PARTS LISTS	11
3. INSTALLATION.....	20
3.1 INSTALLATION HIGHLIGHTS.....	20
3.2 ELECTRICAL POWER.....	20
3.3 CONTROL HEADS.....	21
3.4 ACTUATORS.....	22
3.4.1 General.....	22
3.4.2 6527-S Electronic Actuator.....	23
3.4.3 Throttle Actuator Operation.....	23
3.4.4 Clutch Actuator Operation.....	23
3.5 THE 6503 CARD.....	23
3.6 CABLE INSTALLATION.....	25
3.7 SYNCHRONIZER.....	26
3.8 SHAFT BRAKE/NEUTRAL SAFETY OUTPUT.....	27
3.9 PERIODIC SYSTEM MAINTENANCE.....	27
4. OPERATION.....	28
4.1 STATION CONTROL HEAD.....	28
4.1.1 Station Select.....	28
4.1.2 Station Lock.....	28

4.1.3	Throttle Override (Engine Warm Up).....	28
4.1.4	Synchronizer.....	29
5.	INSTALLATION CHECKLIST.....	30
5.1	GENERAL.....	30
5.2	ACTUATORS.....	30
5.3	THE 6503 ELECTRONIC CARD.....	31
5.4	CONTROL HEADS.....	31
5.5	SYNCHRONIZER.....	31
5.6	CABLE INSTALLATION.....	32
6.	SYSTEM SETUP AND TEST PROCEDURES.....	33
7.	TROUBLESHOOTING.....	35
8.	MIGHTY MARINER OPERATING INSTRUCTIONS.....	38
9.	PERIODIC SYSTEM MAINTENANCE.....	40
10.	CONTROL HEAD CALIBRATION.....	41
	Installation Of Mechanical Pickup For Engine Synchronization And Tachometers.....	42

Appendix: DRAWINGS

400929	DOUBLE STATION SINGLE ENGINE BLOCK DIAGRAM
400930	DOUBLE STATION TWIN ENGINE BLOCK DIAGRAM
400931	6505S CONTROL HEAD CONNECTION DIAGRAM
400932	6527-S ACTUATOR WIRING DIAGRAM
400933	SYNCHRO PICKUP WIRING DIAGRAM
400934	NEUTRAL SAFETY SWITCH WIRING DIAGRAM
400935	BRAKE SWITCH WIRING DIAGRAM
400936	CABLE SCHEDULE
400937	DOUBLE STATION SINGLE ENGINE DETAILED WIRING DIAGRAM
400938	DOUBLE STATION TWIN ENGINE DETAILED WIRING DIAGRAM
400939	DOUBLE STATION TWIN ENGINE BLOCK DIAGRAM
	7176 SATELLITE / 6505-2000 CONTROL PANEL
400940	DOUBLE STATION TWIN ENGINE BLOCK DIAGRAM
	6506 CONTROL HEADS / 6505-2000 CONTROL PANELS
400941	6505-2000 CONTROL PANEL / 7176 SATELLITE CONNECTION DIAGRAM

401045 6505 - 2000 CONTROL PANEL / 6506 CONTROL HEADS CONNECTION
DIAGRAM

401126 6503 ELECTRONIC INTERFACE CARD CONNECTION DIAGRAM

401127 DOUBLE STATION SINGLE ENGINE ELECTRIC CLUTCH / ELECTRONIC
THROTTLE BLOCK DIAGRAM

401128 DOUBLE STATION TWIN ENGINE ELECTRIC CLUTCH / ELECTRONIC
THROTTLE BLOCK DIAGRAM

401129 DOUBLE STATION SINGLE ENGINE ELECTRIC CLUTCH / ELECTRONIC
THROTTLE DETAILED WIRING DIAGRAM

401130 DOUBLE STATION TWIN ENGINE ELECTRIC CLUTCH / ELECTRONIC
THROTTLE DETAILED WIRING DIAGRAM

401131 6503 ELECTRIC CLUTCH DETAILED WIRING DIAGRAM

401132 6503 ELECTRONIC THROTTLE DETAILED WIRING DIAGRAM AND SET
UP PROCEDURE

1. GENERAL INFORMATION

Kobelt Electronic Control System

The Kobelt Electronic Control System is a high performance system using the latest development in industrial control technology. This system is capable of controlling single engine and twin engine vessels installations, from one or more control stations.

Available Features

The available features of the system are as follows:

- Heavy Duty Indoor and Outdoor Control Heads
- Independently Adjustable Shift and Throttle Outputs
- Single or Twin Screw Control
- Engine Warm Up
- Adjustable Shift and Throttle Delays
- Station Lock Out From All Stations
- Selectable Synchronizers
- Shaft Brake/Neutral Safety Switch Outputs
- Up to Four Control Stations
- Self Monitoring
- Throttle Boost
- Mechanical Throttle / Clutch Outputs
- Electronic Throttle / Clutch Outputs

Setup And Calibration

The system setup and calibration can be maintained through switches and adjustable trimpots.

- The Clutch and Throttle stroke adjustment can be made by adjusting the trimpots on the Actuator.

See drawing 400932 for the 6527-S Actuator

Pay Attention To The Diagrams

The document text provides a general overview of the installation and operation processes. Please pay attention to all of the warnings, product tolerances and limitations discussed in this manual.

WARNING: Always ensure that the electrical power is shut off or disconnected from the Kobelt Electronic Control System before making or adjusting any electrical cable connections.

WARNING: When making the installation, pay close attention to matching the wire colours with the correct terminal numbers, as shown in the diagrams. Any incorrect connection can severely damage the system.

2. SYSTEM COMPONENTS

2.1 THE 6527-S ACTUATOR

Description	The Actuator is the heart of the (Mighty Mariner) Kobelt Electronic Control System. The Actuator monitors all input information from the Control Heads and their associated switch panels, its lever position and the synchronizer inputs. The Actuator also controls and positions its Throttle and its Clutch Levers and communicates with the Control Stations through panel lights and sonalerts.
Purpose	The purpose of an Actuator is to operate the Clutches and Throttles as they all require mechanical positioning.
Circuitry	The Actuator uses standard Microchip PIC processor circuitry. All of the system adjustments can be maintained through adjustable trimpots and DIP switches.
Housing	The circuitry is housed in a heavy duty enclosure.
WARNING:	All units are not waterproof and therefore should not be immersed in liquid or washed. This unit should also not be welded, beaten, smashed or dropped.
Connections	All connections to the Actuator are hardwired into pluggable connectors on the board. <i>See drawing 400932.</i>
Throttle Output	As the Station Control Head Lever is advanced through the Throttle portion of its travel, the Actuator output increases proportionately to increase the engine speed.
Clutch Output	For the Clutch Actuator output, the Station Control Head Lever is moved to the forward or reverse position, and the Actuator repositions the Clutch Lever accordingly.
An Adjustable Synchronizer System	The Synchronizer System is adjustable to designate either the port or starboard Engine as the Main Engine.

Model 6527-S	The 6527-S Actuator is a two function Actuator with a mechanical disconnect function.
Working With the CPU	The Actuator repositions its levers by sending electrical signals to its drive motors. The corresponding movements of the levers are fed back to the Actuator card by a gear operated potentiometer to complete the control loop.
Power Failure:	During a power failure the Actuator levers stays in position.
Override:	The mechanical override can be used to operate the lever during a power failure.
Torque	The 6527-S Actuator can deliver 150 inch-pounds of torque.
Temperature	The operating range of the 6527-S Actuator is -10° to +55° Celsius.
WARNING:	This unit, while traditionally mounted in or around the engine room, should not be mounted where excessive heat or moisture is present. Nor should it be mounted next to high power devices such as motors, heaters or transmitters.

2.2 THE 6503 ELECTRONIC CARD

Description	The 6503 monitors all input information from the control heads and their associated switch panels, its clutch and throttle positions and the synchronizer inputs. The 6503 also controls and positions its electronic throttle and its electric clutch and communicates with the control stations through panel lights and sonalerts.
Purpose	The purpose of the 6503 is to operate the clutch solenoid via dry contacts and the electronic throttle via 4 - 20mA, 0 - 5VDC or PWM signal.
Circuitry	The 6503 uses standard Microchip PIC processor circuitry. All the system adjustments can be maintained through adjustable trimpots and DIP switches. See drawing 401-126
Housing	The 6503 is housed in a heavy duty enclosure (7173 - K box) designed to prevent dust and moisture intrusion.

WARNING: The 6503 enclosure is splash proof only and therefore should not be immersed in liquid or washed. This unit should also not be welded, beaten, smashed or dropped.

Connections All connections to the 6503 are hard wired into pluggable connectors on the board. *See drawing 401129 / 401130*

NOTE: Improper wiring connections may result in damage to the 6503

Throttle Output The 6503 has three types of electronic throttle available
4-20mA, 0-5VDC and PWM (Pulse Width Modulation)
See drawing 401132

As the Station Control Head lever is advanced through the throttle portion of its travel, the 6503 output increases proportionately to increase the engine speed.

Clutch Output For the electric clutch output, the station control head lever is moved to the forward or reverse positions and the 6503 enables the appropriate relay dry contacts to energize the clutch solenoid accordingly.
See drawing 401131

An Adjustable Synchronizer System The Synchronizer System is adjustable to designate either the Port or the Starboard engine as the Main Engine.

Model 6503 The 6503 unit is a two function control card that will provide electronic throttle output and clutch solenoid control.

Power Failure During a power failure the 6503 throttle signal will default to 0 and the clutch relay contact will be de-energized. Therefore, the throttle will default to idle and the clutch to neutral.

Temperature: The operating range of the 6503 is -10° to + 55° Celsius.

WARNING: This unit, while traditionally mounted in or around the engine room, should not be mounted where excessive heat or moisture is present. Nor should it be mounted next to high power devices such as motors, heaters and transmitters.

2.3 STATION CONTROL HEADS

Interacting With The Actuator

The Station Control Heads let the operator interact with the Actuator / the 6503 in the following manner:

- The ship's operator sends instructions to the Actuator / 6503 through control handles and buttons.
- The Actuator / 6503 sends feedback to the ship's operator through indicator lamps and sonalerts.
- The Control Heads connect to the Actuator / 6503 over the distributed control network, through a shielded twisted pair data cable.

The Control Heads are manufactured from top quality non-corrosive materials to provide for a long life and an attractive appearance.

Styles

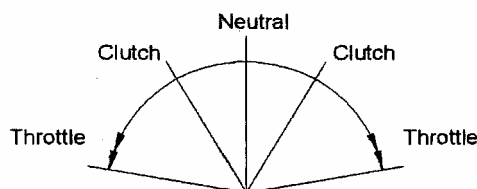
The Station Control Heads are waterproof from the top side only and capable of withstanding wet weather conditions and can be supplied with either a chrome, white, bronze or black epoxy finish.

The bottom of the Control Head must be protected from the weather.

Engaging The Clutches And Throttles

The Control Heads operate through approximately 80 degrees of travel from each side of the centre neutral position. The first 30 degrees per side operate the Clutches and the remaining 50 degrees per side operate the Throttles.

This graphic shows the side view of a Control Head and the limits of its clutch and throttle regions.



2.4 SYNCHRONIZER INPUT

Purpose

The Synchronizer is an optional feature which can be added to any new or existing system. The Synchronizer adjusts the speed (shaft RPM) of the Following Engine to match the speed of the Leading Engine.

Proximity Sensor

The Synchronizer input circuitry uses a proximity sensor mounted on the ship's propeller shafts. The propeller shaft speed is monitored, in preference to the engine speed, to ensure that the propellers are synchronized.

2.5 SHAFT BRAKE/NEUTRAL SAFETY SWITCH OUTPUT

Purpose

The operation of Shaft Brake/Neutral Safety Switch is coordinated with the Kobelt electronic Control System. The output from this switch indicates that the system is in the neutral position, helping the operator perform safe engine startups and idling.

Engine Start Interlock

NOTE: The Shaft Brake/Neutral Safety Switch can be tied to the engine's starting circuitry. This will prevent the engine from starting unless the Control Head levers are in their neutral positions.



Picture showing the electronic control head 6501-TC c/w the optional panel base

MODEL 6501S ILLUMINATED ELECTRONIC CONTROL HEAD (MIGHTY MARINER SYSTEM)

The 6501S is the illuminated version of the 6505S control head used in the “Mighty Mariner” system which offers not only compact design but the features of a full size control. Where space and visibility are limited this is the head of choice.

The housing and handles are manufactured of bronze and stainless steel. Finish options include chrome, black or white epoxy paint and polished bronze.

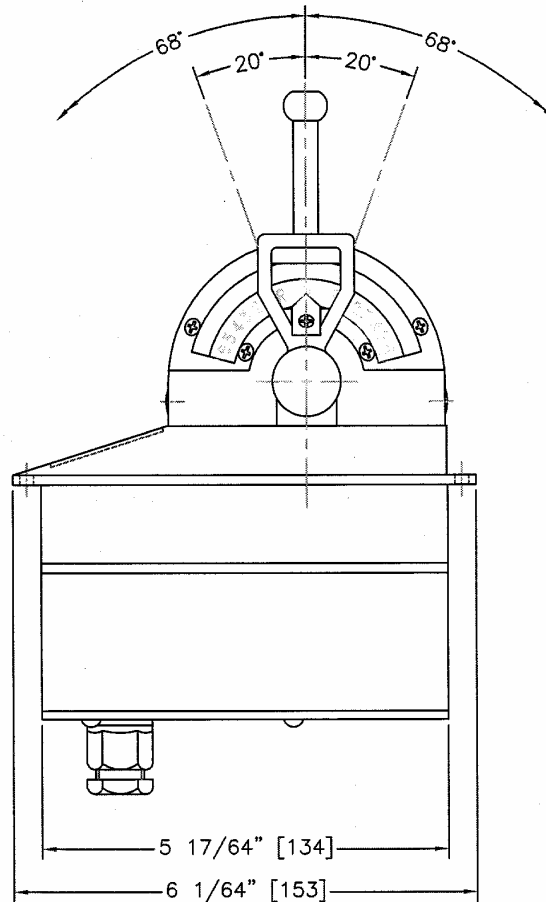
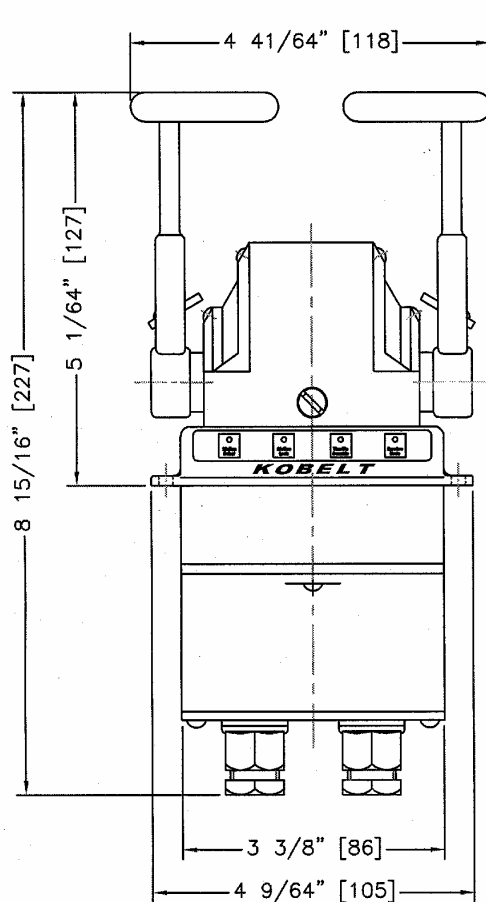
The unit uses a water resistant keypad but is not waterproof. The keypad offers switches for the standard features: Station Select, Station Lock, Throttle Override and Synchronization. Incorporation of the latest electronic technology allows this head to team up with any of the Kobelt “Mighty Mariner” control systems.

The standard head comes without base but with potentiometers. Options are available.

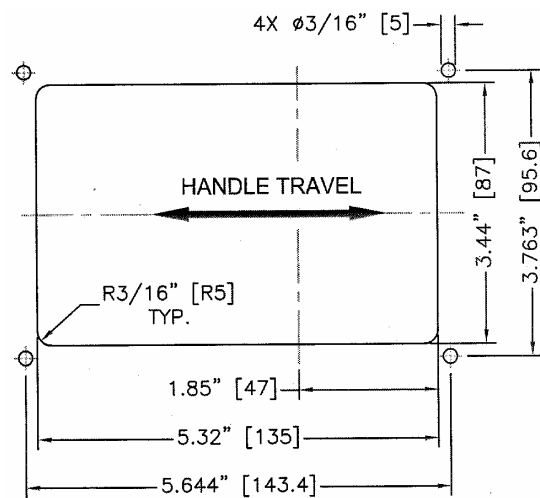
# Engines:	single or twin
Finish:	chrome or black or white or polished bronze
Handle:	standard, plastic grip or ‘Elegante’ style
# Potentiometer:	one or two
Panel keypad:	four switches

Please visit our website <http://www.kobelt.com> for more information.

MODEL 6501S



All Dimensions in inches (mm)



CUT-OUT DIMENSIONS



Standard two-engine control
head in black finish



Control head in white finish
and "E" style handles

MODEL 6505S CONTROL HEAD (MIGHTY MARINER SYSTEM)

This unit has a compact design yet offers all of the features and accuracy of our larger models. Evolved from the popular 6505 model, the 6505S head includes a microprocessor that is used exclusively with the Mighty Mariner system.

The unit can be used

- in combination with the 6527-S clutch/throttle actuator for mechanical control
- in conjunction with Model 6503 Electronic Interface unit to provide electric clutch / electronic throttle outputs

The unit can be used on a single or twin engine configuration. (See examples on the reverse page for different system configurations.)

The unit incorporates the latest technology with provision for switch pad buttons for Station Select, Station Lock, Throttle Override and Synchronizer.

The housing and handles are constructed in all bronze and stainless steel. The standard unit comes in chrome, black epoxy, white or polished bronze finish.

The unit is watertight from the top side and can be used anywhere on board ship. However, the bottom side must be protected from the environment.

For more information about the Mighty Mariner system, please contact Kobelt Manufacturing or visit the website <http://www.kobelt.com>

MODEL 6505 S

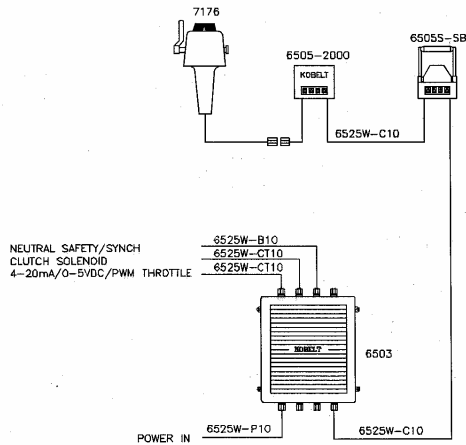
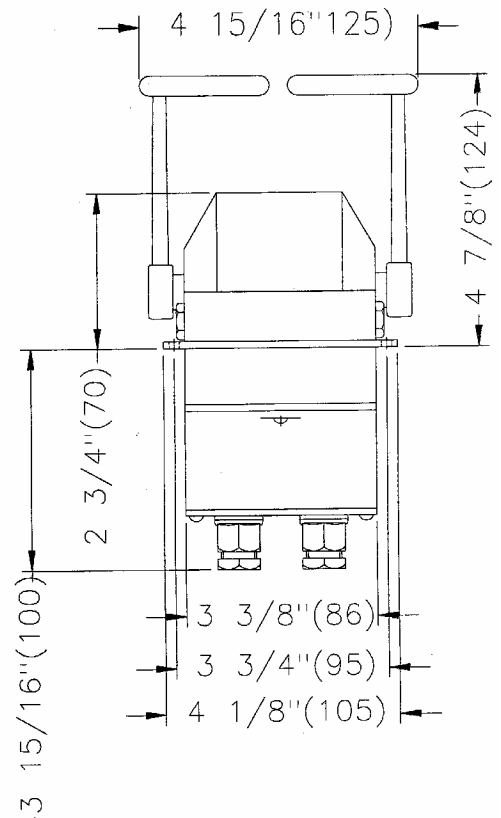
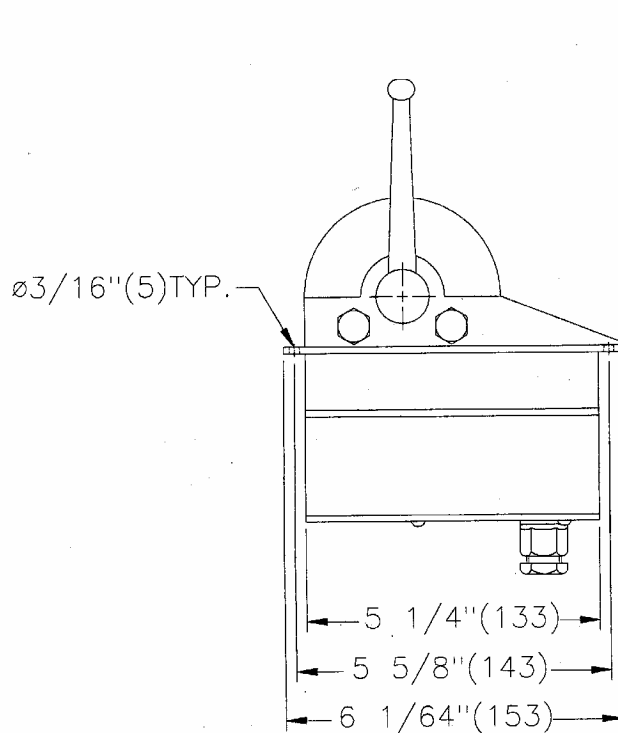


Fig.1 Two control stations for electronic throttle output and electric clutch control configuration

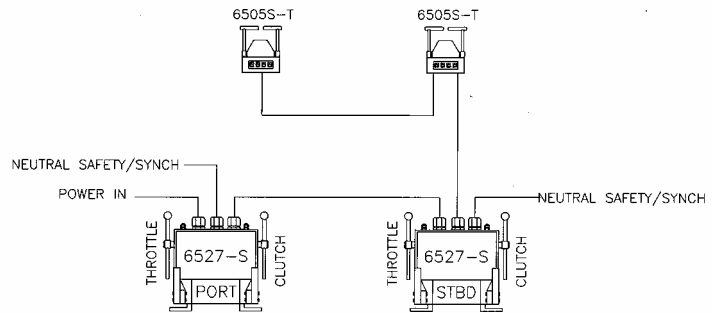


Fig. 2 Two stations Twin engine clutch/throttle actuator configuration

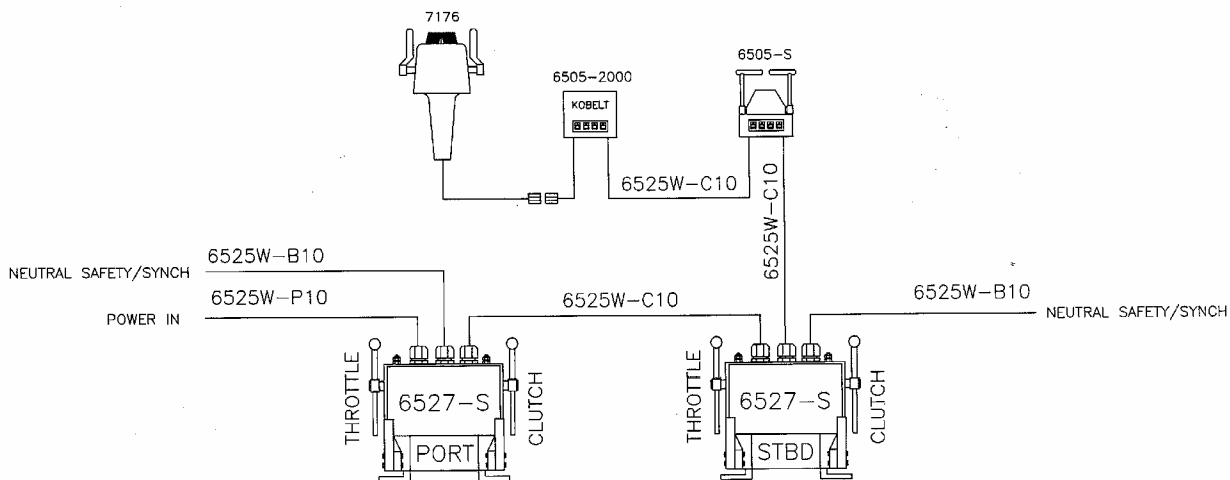


MODEL 6505-2000 REMOTE SELECTOR PANEL

The 6505-2000 Remote Selector Panel allows the Walk-About Controller (Model 7176), the Side Mount Controls (Model 6506) or the Model 6555 Control Head to interface with the Kobelt Mighty Mariner System.

This remote unit has all the basic functions available on a 6505S Control station and is suitable for inside or outside installation.

An example of a twin engine, two station system using 7176 is shown as below. You can also get systems for one or two engines, and from one to four stations as well.



TYPICAL SYSTEM ARRANGEMENT

(Note: 7176 can be replaced by selected Kobelt Control Head)



MODEL 6506 SIDE MOUNT CONTROL

The 6506 is a side mounting electronic control which can be used for single lever clutch and throttle or any combination of CP propeller and/or trolling valve. This unit is constructed in bronze and stainless steel and the housing is available in chrome and/or black epoxy, (the control handle is always supplied in chrome).

The handle is attached to the control on a 36-tooth spline and can, therefore, be rotated in 10° increments to suit the installation.

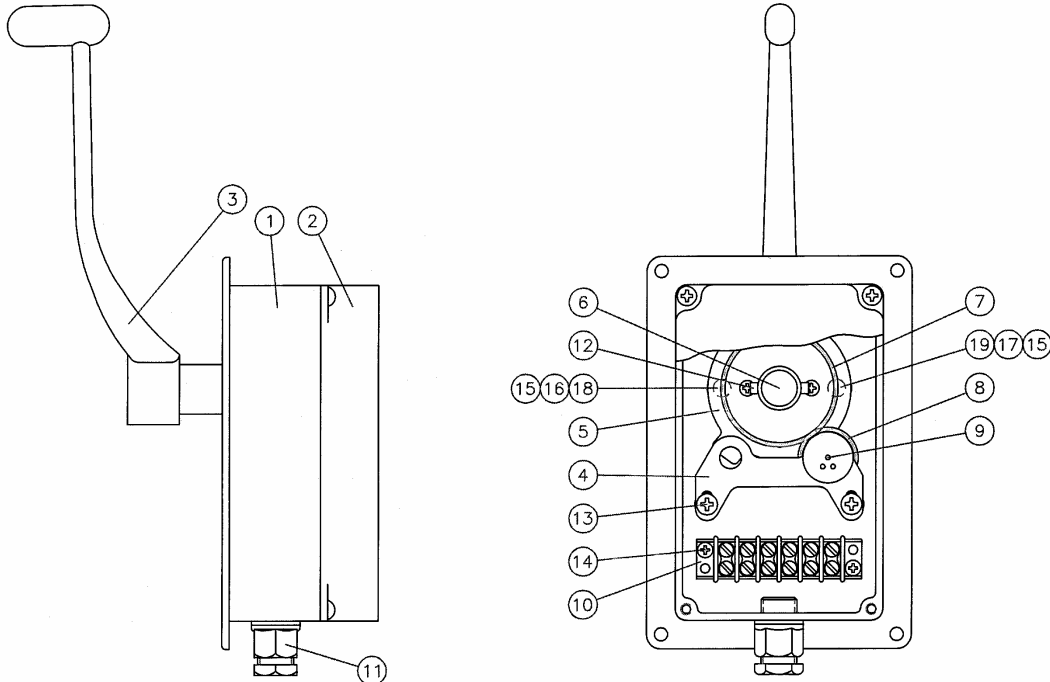
Weight: 6.6 lb (3 kg)

Ordering Information: 6506-B for black housing
6506-C for chrome plated housing

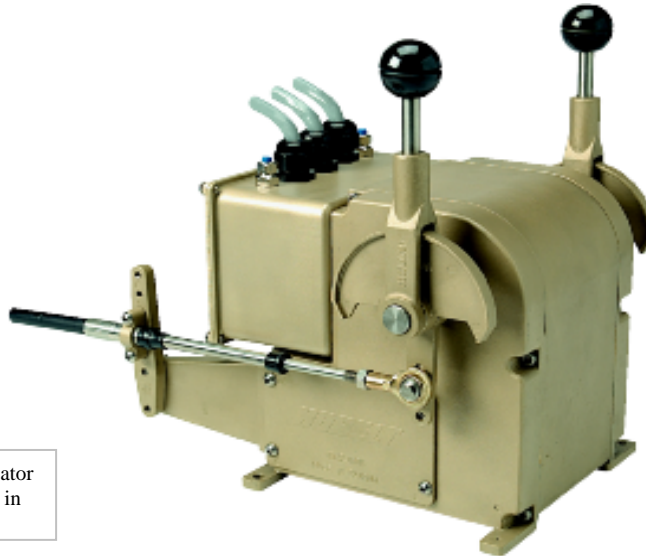
The control is normally flush-mounted to the control console. The unit is equipped with friction and detent mechanisms and can be adjusted to meet customer's requirement.

The unit is also available with two potentiometers. The KOBELT computer unit will read both potentiometers but should one fail, the computer would recognize and ignore the incorrect signal. This control requires an external headboard (Model 6507 is recommended) and is compatible with all other KOBELT control devices.

DIMENSIONS AND PARTS LIST MODEL 6506



Item	Qty	Part Number	Description
1	1	6506-0001	Housing
2	1	6506-0002	Cover
3	1	6506-0003	Handle
4	1	6506-0004	Bracket
5	1	6506-0005	Cam
6	1	6506-0006	Shaft
7	1	YP3264	Spur gear
8	1	YPB3232	Pinion
9	1	POT-5	5K Potentiometer
10	1	6009-0006	Terminal block
11	1	6001-0249	Connection gland
12	1	1024-0812	Spring pin
13	6	1010-0824	Round head Philips screw
14	4	1012-0606	Pan head Philips screw
15	2	1016-1204	Set screw
16	1	1201-0002	Spring
17	1	1201-0003	Spring
18	1	2542-0008	Friction plug
19	1	2009-0011	Detent plunger



Picture shows 6527 actuator with cable (not included in standard unit)

Model 6527-S Electronic Actuator

Being a modified version of the regular 6527 actuator, the 6527-S actuator is used exclusively in the Kobelt Mighty Mariner System to operate and position lever-actuated mechanisms. Using the latest technology in propulsion control, this actuator unit forms the heart of the Mighty Mariner Control System. The actuator monitors all input information from the control heads and their associated switch panels, its lever position as well as the synchronizer input. This actuator also controls and positions its Throttle and Clutch levers and communicates with the control stations through panel lights and sonalerts. The 6527-S electronic actuators are constructed in bronze and stainless steel, except for the motor and worm. This unit has a high torque of 180 in-lbs.

The basic unit on Model 6527-S comes with manual override and one trim pot per side for stroke adjustment. The actuator does not have an internal resilient link. Hence the stroke must be precisely adjusted to suit the device being controlled.

Note: This actuator is not waterproof and therefore should not be immersed in liquid or washed.

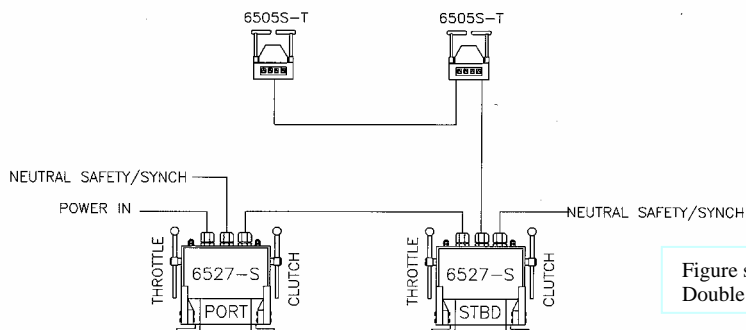
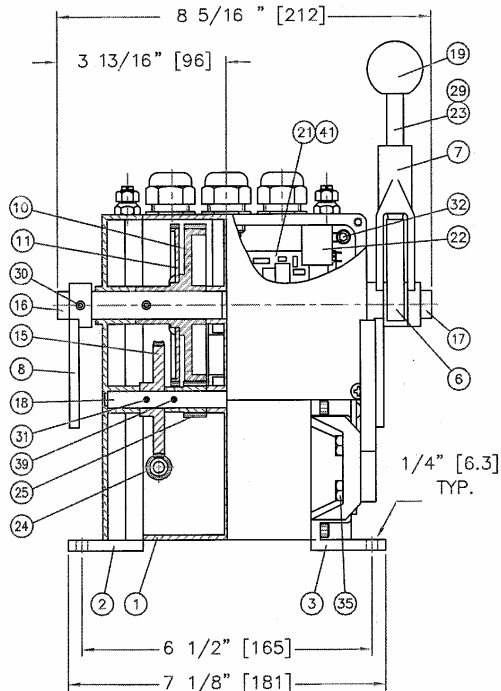
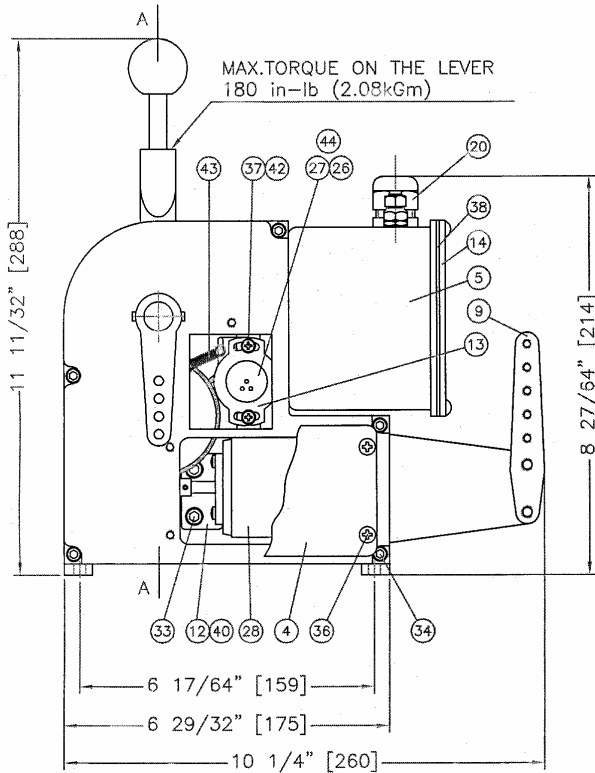


Figure shows typical configuration for Double station Twin engine system

MODEL 6527-S



SECTION A-A

All dimensions in inches (mm)

Item	Qty	Part Number	Description
1	1	6527-0001	Centre Housing
2	1	6527-0002	Side Housing
3	1	6527-0003	Side Housing
4	2	6527-0004	Cover
5	1	6527-0005	Connection Housing
6	1*	6527-0006	Disconnect Cam
7	1*	6527-0007	Disconnect Arm
8	1*	6527-0008	Lever
9	2	6527-0009	Stationary Arm
10	2	6527-0010	Spur Gear
11	2	6527-0011	Feedback Gear
12	2	6527-0012	Motor Bracket, right
13	1	6527-0013L	Potentiometer Bracket – left
13	1	6527-0013R	Potentiometer Bracket – right
14	1	6527-0014	Cover
15	2	6527-0015	Worm Gear
16	1*	6527-0016	Shaft - Short
17	1*	6527-0017	Shaft - Long
18	2	6527-0018	Shaft
19	2	2030-0001	Knob Black
20	3	6001-0249	Connecting Gland
21	2	6527-1001	Circuit Board
22	2	6002-4000	Trim Pot – 1K
23	1*	6524-0015	Handle
24	2	6524-0019	Worm
25	2	6524-0021	Pinion
26	2	6524-0022	Potentiometer Drive Gear
27	2	POT-5	Potentiometer – 5K
28	2	Motor-14201	Motor Pittman 24VDC, "14201E175-R1"
29	1*	1201-0140	Spring
30	4	1024-0818	Spring Pin
31	2	1024-0512	Spring Pin
32	4	1002-0806	Socket Hd Cap Screw
33	4	1002-1008	Socket Hd Cap Screw
34	10	1002-0808	Socket Hd Cap Screw
35	4	1001-1012	Hex Hd Machine Screw
36	22	1010-0806	Round Hd Philips Screw
37	20	1012-0606	Pan Hd Philips Screw
38	1	6527-0022	Gasket
39	2	1024-0510	Spring Pin
40	1	6527-0012A	Motor Bracket, left
41	1	6527-1002	Heat Sink
42	4	6527-0020	Bushing
43	2	1202-0011	Spring
44	2	1016-0602	Setscrew

* Quantity may vary

Weight : 24 lbs (11 kg)

3. INSTALLATION

3.1 INSTALLATION HIGHLIGHTS

Starting Installation

1. Engine start/stop must be installed at every station.
2. Kobelt system power breaker must be installed in the wheel house.
3. Wires must be tinned during installation.
4. Free wheeling diodes (protection diodes) must be installed on all inductive devices such as relays and solenoids.
5. Kobelt neutral safety switches must be able to be bypassed to allow starting of the engines if the control system has failed.
6. A clean power source must be provided.

3.2 ELECTRICAL POWER

Power Requirements

Power requirements for the Kobelt Electronic Control System are as follows:

- 24 vDC power supply - 10 amps maximum

Battery charge Regulation - 10% from no load to full load with 10% maximum line variation

Clean Power Is Critical

A reliable and electrically clean power supply for this system is critical.

- “Main” power should not be taken from an engine starting battery source.
- Power should be taken from the ship’s house battery through a circuit breaker.
- If there is noise on the ship’s house battery system caused by electronics or inverters, it is recommended that a battery dedicated to the electronic engine controls be installed.
- Voltage regulation from the battery charger, inverter or converter should be 10% or better.

**Power Switch
(Customer
Supplied)**

Two sources of power are recommended: A primary source and a secondary source. A three position switch capable of handling system current must be installed next to the main station, usually the wheelhouse station, to allow the operator to select either the primary power, the secondary power or, in an emergency, the POWER OFF/SYSTEM RESET position.

**Shielding And
Ground
Connections**

All shielding and ground connections for the Kobelt Electronic Control System are made at the Actuator / the 6503 Control Unit

- The Actuator / 6503 Card is grounded internally, therefore it is best to completely isolate from the ship's grounding.

3.3 CONTROL HEADS

Mounting

The Control Head circuitry is subject to the same temperature range as the Actuator. The Control Heads should be mounted so they may be lifted up through their mounting holes with their wiring intact.

DIP Switches

The DIP Switches on the printed circuit board are used for assigning an address to each Control Head. The Main Station is assigned number 1. The Second Station is assigned number 2. When the system is powered up, the CPU will automatically default to Station 1.

All Control Heads are set to Station #1 when delivered. For a multi station system, the stations addresses must be set during the installation.

See drawing 400931

Options

All standard Control Heads will come with a four-selection membrane switch with LED indicators. These switches will include options for STATION SELECT, STATION LOCK, THROTTLE OVERRIDE, and SYNCHRONIZER.

3.4 ACTUATORS

3.4.1 General

Mounting	All Actuators perform best when they are installed on relatively vibration-free foundation plates.
WARNING:	Do not mount the Actuator on the engine. All units are not waterproof and therefore should not be immersed in liquid or washed. This unit should also not be welded, beaten, smashed or dropped.
Temperature	The operating range of the 6527-S Actuator is -10° to +55° Celsius.
WARNING:	This unit, while traditionally mounted in or around the engine room, should not be mounted where excessive heat or moisture is present. Nor should it be mounted next to high power devices such as motors, heaters or transmitters.
Rod Ball End Connections	<p>If a push/pull cable is selected, it must be a low friction type, such as the Felsted type 40 series, and should be kept as short and straight as possible.</p> <p>Must: Please follow cable manufacturer specifications when installing push/pull cable.</p>
Mounting Bracket	<p>The Actuator's Mounting Bracket should be flat to avoid distortion of the Actuator housing.</p> <p>WARNING: When installing the Actuator, it is mandatory to place a small flat washer under each of the four mounting feet. This is to ensure that there is no distortion of the case when the unit is mounted.</p>
Electrical Connections	<p>Connections at the Actuators are made via removable connectors mounted inside the Actuator just inside the removable panel. Cut the cable to the appropriate length.</p> <p>WARNING: Do not coil up excess cable.</p>
Check The Diagrams	<p>Check the appropriate wiring diagram for the Actuator. The cable specification and wiring diagrams are at the back of this manual.</p> <p>NOTE: Care must be taken with connections made at the Actuator. Improper wiring connections may result in damage to the Actuator.</p>

FOR ITEMS THAT NEED ACCURATE POSITIONING, A PUSH PULL CABLE IS NOT RECOMMENDED BECAUSE OF THE LOST MOTION IN PUSH PULL CABLES. A SOLID ROD WITH ROD BALL ENDS IS RECOMMENDED.

3.4.2 6527-S Electronic Actuator

Description

The basic control unit on model 6527-S comes with manual override and one trim pot per side to adjust the stroke. The actuator does not have an internal resilient link. The stroke must, therefore, be adjusted precisely to suit the device being controlled. This unit has a high torque of 150 in. lbs.

3.4.3 Throttle Actuator Operation

Throttle Movement

The standard throttle actuator operates in a counter clockwise rotation for more RPM and a clockwise rotation for less RPM.

Electrical Reversal

If this movement is reverse to what is desired, the actuator can be electrically reversed by setting DIP switches.

See drawing 400932

3.4.4 Clutch Actuator Operation

Operation

The standard clutch actuator operates in a clockwise rotation for forward and counter clockwise rotation for reverse. The direction can be changed electrically as previously explained.

3.5 THE 6503 CARD

Mounting

Do Not Mount the 6503 on the Engine or the Clutch

The Electronic circuitry of the 6503 is mounted in a die-cast silicon bronze housing.

WARNING: This enclosure is not waterproof and therefore should not be immersed in liquid or washed. This unit should also not be welded, beaten, smashed or dropped.

Temperature	The operating range of the 6503 is -10° to +55° Celsius.
WARNING:	This unit , while traditionally mounted in or around the engine room, should not be mounted where excessive heat or moisture is present. Nor should it be mounted next to high power devices such as motors, heaters and transmitters.
Electrical Connections	All connections to the 6503 are hardwired to removable connectors on the card. Cut the cable to the appropriate length.
WARNING:	Do Not Coil Up Excess Cable
Check The Diagrams	Check the appropriate wiring diagram for the 6503. The cable specification and wiring diagrams are at the back of this manual.
NOTE:	Improper wiring connections may result in damage to the 6503 card.
Electronic Throttle Operation	<p>The throttle output can be selected to provide a 4 to 20mA, 0 to 5 VDC or a PWM signal for electronic governor systems. One output will be selected during the installation.</p> <p><i>See drawing 401132</i></p>
Throttle Movement	The standard throttle produces Minimum signal for idle RPM and Maximum signal for full RPM. For example, 4 mA is equal to idle speed and 20 mA is equal to full speed.
Electrical Reversal	<p>If the electronic signal is reversed to what is desired, it can be electrically reversed by setting DIP switches.</p> <p><i>See drawing 401126</i></p>
NOTE:	Reversing the engine signal might cause damage to the clutch. Extreme caution is required.
Throttle Cable	<p>The cable used is 3-conductor #18 AWG shielded. The white wire is positive and the black wire is negative. The shield is connected at the 6503 card.</p> <p>NOTE: The red wire is not used and must be cut and isolated. The shield must not be connected to the engine side.</p> <p><i>See drawing 401132</i></p>

Electric Clutch Operation The 6503 card will provide relay dry contacts output to control the electric solenoid gear drives based on the control head command. The 6503 card will operate the clutch relays which provide a closed contact to operate the gear solenoids.

Electrical Reversal If the gear operation is reversed to what is desired, it can be electrically reversed by setting DIP switches.

See drawing 401126

Electric Clutch Cable The cable is 3-conductor #18 AWG shielded. The white wire is forward, the red wire is reverse and the black wire is solenoid common.

See drawing 401131

NOTE: **The shield is not used and must be cut and isolated.**
Protection diodes must be installed to reduce voltage spikes.

Protection diodes are supplied.

3.6 CABLE INSTALLATION

WARNING: Do not install any cables until after the Actuators or the 6503 card, Control Heads and Synchronizer Inputs have been mounted in their permanent locations.

Cables All cabling should be firmly fastened, unless housed in conduit. All cables are supplied to the length of 10 meters (33 feet) unless specified.

WARNING: **Cut the cables if they are too long, do not coil them.**

Power Cable The power cable supplied is #12 - 2 conductor. The Red is positive power and the Black (Blk) is negative power.

Communication Power Cable The Communications/Power Cable provides communications and power from the Actuator / the 6503 card to the Station Control Heads.

See Drawing 400936

WARNING: The total length of the communication cable 6525W-C10 must not exceed 40 meters (132 ft).

This Communications/Power Cable is grounded at the Actuator / the 6503. Connect the shield to the Control Headboard terminal but NOT to the case.

Throttle Cable	The throttle cable is 3-conductor #18 AWG <i>See drawing 401132</i>
Synchronizer Cables	The Synchronizer cable is 7-conductor #18 AWG. <i>See Drawing 400933</i>
Clutch Cable	The clutch cable is 3-conductor #18 AWG <i>See Drawing 401131</i>
Shaft Brake/ Neutral Safety Cable	The Shaft Brake/Neutral Safety Cable is 7-conductor #18 AWG. <i>See Drawing 400934 / 400935</i>
Control Head Panel Wiring	All wiring for Control Head panels, between the Control Heads and the push buttons and lights, are factory installed and tested.

3.7 SYNCHRONIZER

Mounting	The Synchronizer Pickups are mounted near the propeller shafts. These are proximity sensors that send one pulse per shaft revolution to the Actuator.
Target Size	The target size for the Pickup should be 2-3" long, 1" wide and about 1/8" thick. Depending on the installation, slightly larger Pickups may be required to make the Synchronizer respond properly.
Material	The recommended material is mild steel. If stainless steel is used, the sensing distance of the Pickup may be less.
Sensing Gaps	The recommended maximum sensing gap for mild steel is approximately 0.050" (1.4mm). If stainless steel is used for a target, the maximum sensing gap will be approximately 0.035" (1mm).

NOTE: Please review the instructions that come with the Sensor. The Pickup should be mounted on a vibration-free bracket that allows for adjustment of the sensing gap.

See Drawing 400933

3.8 SHAFT BRAKE/NEUTRAL SAFETY OUTPUT

Operation	The Shaft Brake Output features a set of normally open contacts: They close when the Clutch is in the neutral position. As the Forward or Reverse Clutch is activated, the Brake Relay disconnects and the Brake is deactivated.
Relays	The Neutral Safety Switch Output uses the same relay as the Shaft Brake. The relay is interlocked to Clutch Neutral Position.

3.9 PERIODIC SYSTEM MAINTENANCE

Inspection	<p>Inspect system wiring:</p> <ul style="list-style-type: none">• Control heads wiring• Actuators wiring• 6503 Electronic card wiring <p>Inspect and monitor your primary and secondary power sources.</p> <p>Inspect your push/pull cable connections between actuators and controlled devices. Check cable clamp screws and make sure they are tight.</p> <p>Perform a system functional test with the engines off and test system operations from all stations and for all functions available (see Kobelt operating instructions).</p>
-------------------	--

4. OPERATION

4.1 STATION CONTROL HEAD

4.1.1 Station Select

Purpose	The STATION SELECT button allows you to transfer engine control from one station to another.
Selecting	To select a Station, press the STATION SELECT button. After the Station has been selected, the STATION SELECT lamp will illuminate to <u>indicate that the transfer has been completed</u> . This lamp will not turn off until another Station is selected. When a Station is selected, all operating functions are transferred to that Control Head.
Main Station	When the engine Control System is first activated electrically, the Main Station (Stn 1 - switch designation) is automatically selected as the Station in control, and the Station Lock function is activated. The control head levers must be set to neutral then push the STATION SELECT button to make the system operational.

NOTE: On Power-Up control levers must be set to neutral / idle in order to take control.

4.1.2 Station Lock

Purpose	The Station Lock allows the operator to lock out the other stations. This feature is used to prevent someone from inadvertently switching Station control from the ship's operator at the active Station.
Engaging	It can be engaged by pressing the STATION LOCK button of the active Station. When it is engaged, the STATION LOCK lamp will illuminate and no other Station can be selected. Pressing the button again will release the Station Lock and the STATION LOCK lamp will turn off.

4.1.3 Throttle Override (Engine Warm Up)

Purpose	Throttle Override (engine warm up) mode allows the ship's operator to move the Throttle independently of the Clutch. This is useful for engine warm up or to increase the engine's speed for external loads (e.g. - hydraulic pump systems). The Neutral Safety Switch will be enabled during engine warm up.
----------------	---

**Shifting To
Throttle
Override**

Move the Control Handles to the neutral position, then press the THROTTLE OVERRIDE button. After the button has been pressed, the THROTTLE OVERRIDE lamp will illuminate. The Throttle Override mode prevents the Clutch from moving out of the neutral position.

**Returning
To Normal**

To select the normal operating mode, return the Control Handles to the neutral position, then press the THROTTLE OVERRIDE button again.

4. 1. 4 Synchronizer

**Operation
Engagement/
disengagement**

The Port and the Starboard levers must be within 10% of each other to allow engagement / disengagement of the Synchronizer option. The Synchronizer is activated by pressing the SYNCHRONIZE button. The Synchronizer circuitry will adjust the position of the Auxiliary Throttle based on the Port / Stbd propeller shaft speeds. When the SYNCHRONIZE light is flashing the Synchronizer is working. When the SYNCHRONIZE light is on solid, the shafts are “in sync” within the dead band.

Sensors

The Synchronizer Sensors, or Pickups, are proximity sensors mounted on the propeller shafts to transmit the speed of the propeller back to the System. The System compares the pulsed inputs from the propeller shafts of the Auxiliary and Main Engines, then adjusts the speed of the Auxiliary Engine to match the Main Engine.

Gear Operation

In the Synchronizer mode the selected Control Head will also operate both gears from the Main Handle.

OLD/NEW SOFTWARE REVISIONS:

NOTE: The Synchro operation will be disabled in the case of a twin engine system where system components are using different software versions.

e.g. An older system that has a newer part fitted with revised software.

CONTROL HEAD OLD REVISION IS 3.7.0
CONTROL HEAD NEW REVISION IS 4.0

6527-S ACTUATOR OLD REVISION IS 1.4.4
6527-S ACTUATOR NEW REVISION IS 2.0

5 INSTALLATION CHECKLIST

5.1 GENERAL

- ☐ ENGINE EMERGENCY STOPS must be installed at every station
- ☐ The power source must be clean
- ☐ The voltage regulation must be within 10% or better of rated battery voltage, e.g. a 24 Volt system should be between 22 and 26 Volts
- ☐ A POWER switch (customer supplied) must be installed at the Main Station
- ☐ Do not use an engine starting battery as a power source
- ☐ Do not install any cables until the Actuators, the 6503, Control Heads and Synchronizer Inputs have been mounted in their permanent locations
- ☐ Tin all cables and solder all crimp connectors
- ☐ The operating temperature range is -10°C to +55°C
- ☐ Double check all voltage polarities (positive/negative), reverse polarities are likely to cause damage

5.2 ACTUATORS

- ☐ The Actuator's location must be accessible for service
- ☐ The Actuator must be installed on a relatively vibration-free plate
- ☐ Do not mount the Actuator on the engine
- ☐ Do not install Actuator near high-power devices
- ☐ This unit is not waterproof and, therefore, must not be mounted where excessive heat or moisture is present and it should not be immersed in liquid or washed
- ☐ The Mounting Bracket must be flat
- ☐ Place a small flat washer under each of the four mounting feet
- ☐ If cables are to be used with the Actuators, rather than solid bars, use only low friction push/pull cables such as the Felsted type 40 series and make them as straight as possible to a maximum of 15 feet in length

MUST: Please follow cable manufacturer specifications when installing push/pull cable

- ☐ This unit should also not be welded, beaten, smashed or dropped
- ☐ Connections are made just inside the removable panel
- ☐ Disconnect all cables/remove components prior to welding

5.3 THE 6503 ELECTRONIC CARD

- ☐ The 6503's location must be accessible for service
- ☐ The 6503 must be installed on a relatively vibration-free plate
- ☐ Do not mount the 6503 on the engine or the clutch
- ☐ Do not install the 6503 near high-power devices
- ☐ This unit is not waterproof and, therefore, must not be mounted where excessive heat or moisture is present and it should not be immersed in liquid or washed
- ☐ This unit should also not be welded, beaten, smashed or dropped
- ☐ Connections are made to removable connectors inside the 6503 enclosure
- ☐ Disconnect all cables / remove components prior to welding.

5.4 CONTROL HEADS

- ☐ Mount the Control Heads so that you are able to lift them up entirely through their mounting without having to remove their wiring
- ☐ The Main Station is assigned address number 1, the Second Station is number 2
- ☐ On power up the system will automatically default control to station number 1

5.5 SYNCHRONIZER

- ☐ The Synchronizer Pickups are mounted in close proximity to the propeller shafts
- ☐ The Target size for the Pickups should be approximately 2-3" long, 1" wide and about 1/8" thick. These sizes may be increased if necessary
- ☐ The recommended material is mild steel
- ☐ The recommended maximum sensing gap for mild steel is approximately 0.050"
- ☐ If stainless steel is used for a Target, the maximum sensing gap will be approximately 0.035"
- ☐ The Pickup must be mounted on a vibration-free bracket that allows for adjustment of the sensing gap
- ☐ Review the instructions that come with the Sensor

5.6 CABLE INSTALLATION

- ☐ Cut all cables to their appropriate length
- ☐ Do not coil up excess cable
- ☐ All cabling should be firmly fastened
- ☐ Tin all cable ends
- ☐ Refer to the diagrams for specific details regarding all cable connections
- ☐ Do not run the low-voltage control cables near high-power cables

6. SYSTEM SETUP AND TEST PROCEDURES

Pre-Test Checks	<ul style="list-style-type: none">• Make sure that the system is powered down• Make sure that all cables are labeled• Inspect the system wiring in complete detail, unit by unit
Disconnect	<ul style="list-style-type: none">• Disconnect the PUSH/PULL cables or mechanical linkage from all Actuators / unplug P6 and P7 from the 6503 electronic interface card
Power Up	<ul style="list-style-type: none">• Apply power to the system and observe carefully• The Main Station sonalert should be beeping and the STATION SELECT lamp should light up• If not, power down and inspect all of the wiring again. Then repeat the power up procedure until the system is properly powered up
Station Select	<ul style="list-style-type: none">• Once the system is powered up, set the control lever to NEUTRAL/IDLE and then press the STATION SELECT button to acknowledge control.
6527-S Levers	<ul style="list-style-type: none">• Move the Control Head levers and observe whether the actuators are responding to the lever commands.
6527-S Throttle/Clutch	<ul style="list-style-type: none">• Determine the Minimum and Maximum Throttle positions as well as the forward and reverse Clutch positions and compare these positions to the Actuator's movement• If you need to reverse an Actuator movement <i>See drawing 400932</i>• Determine the stroke required for Clutch and Throttle. Make any <i>coarse</i> adjustments by moving the cable connection up or down on the Actuator lever. Make any <i>fine</i> adjustments by turning the Actuator trimpots to obtain the desired position.
6527 - S PUSH/PULL Cables	<ul style="list-style-type: none">• With the engine shut down, connect the PUSH/PULL cables to the actuators and fine tune for best results.

**6503
Levers**

Using a multimeter, move the control levers and verify whether the throttle signal and the clutch relay contacts are responding to the lever commands.

**6503
Throttle/Clutch**

Determine the type of throttle signal as well as the Minimum and Maximum and adjust the appropriate trimpots until designed signal obtained

See drawing 401132

Note: The 6503 card is already calibrated to produce PWM signal when delivered.

If you need to reverse the throttle or the clutch signal

See drawing 401126

Throttle Delay

- Once signal calibration is complete and with the engine shut down, connect the clutch and the throttle cables to the 6503 electronic interface
- Adjust Throttle trimpot clockwise to increase the Throttle delay. *The maximum delay is 24 seconds*

See drawing 400932 / 401126

Neutral Delay

- Adjust neutral trimpot clockwise to increase the neutral delay. *The maximum neutral delay is 24 seconds.*

See drawing 400932 / 401126

**Completing
The Test**

- Once the system has been thoroughly tested and all of the functions are operational, you may now start the engines and test at the idle RPM.
- After everything has been tested and adjusted properly, you may start preparing for a sea trial.

7. TROUBLESHOOTING

Symptom	Possible Causes	Remedy
The system is dead	<ul style="list-style-type: none"> The power is off The polarity is reversed on the DC power input 	<ul style="list-style-type: none"> Turn the power on Reverse the connections
There is a continuous sonalert beep	<ul style="list-style-type: none"> Control Head CPU hangs up 	<ul style="list-style-type: none"> Reset System
The system is not synchronizing	<ul style="list-style-type: none"> The synchronizer is not set properly There is a problem with the synchronizer wiring Parts are having different software revisions 	<ul style="list-style-type: none"> Adjust the distance between the sensor and the target until the LED starts flashing Check the wiring Software versions need to be matched
All Actuators are moving erratically	<ul style="list-style-type: none"> There is a ground loop 	<ul style="list-style-type: none"> Check and make sure the cable shields are isolated
<u>Single Beep</u> The Control Head will become disabled All control heads will become disabled	<ul style="list-style-type: none"> The 6505 S Control Head, DIP switches are incorrectly set The 6527 - S Actuator or the 6503 interface card DIP switches are incorrectly set 	<ul style="list-style-type: none"> Check the DIP switches setting of the 6505 S control head, 6527 - S actuator or the 6503 interface card
<u>2 Consecutive Beeps</u>	<ul style="list-style-type: none"> System temperature is above 60° C 	<ul style="list-style-type: none"> Must provide ventilation

<u>3 Consecutive Beeps</u> The Actuator will be disabled If the Clutch Actuator fails the Throttle will default to Idle. If the Throttle Actuator fails the Clutch will default to Neutral	<ul style="list-style-type: none"> • The Actuator is jammed • The Actuator motor has failed 	<ul style="list-style-type: none"> • Check the push pull cable • Check the wiring and the motor
<u>4 or 7 Consecutive Beeps</u> The control head will become disabled Station Lock will be disabled Control can be transferred to other stations if equipped	<ul style="list-style-type: none"> • One or more communication wires are missing • One or more terminating resistors are missing 	<ul style="list-style-type: none"> • Check the wiring • Install terminating resistors
<u>5 Consecutive Beeps</u> The Actuator will be disabled. If the Throttle Pot fails the Clutch will default to Neutral If the Clutch Pot fails the Throttle will default to Idle	<ul style="list-style-type: none"> • The Actuator Potentiometer is damaged • One or more of the Pot wires are broken 	<ul style="list-style-type: none"> • Check the Potentiometer and replace if necessary

<p><u>6 Consecutive Beeps</u></p> <p>The Control Head will become disabled</p> <p>Station Lock will be disabled</p> <p>Control can be transferred to other stations if equipped</p>	<ul style="list-style-type: none"> • The Control head Potentiometer is damaged • One or more of the Control head pot wires are broken 	<ul style="list-style-type: none"> • Check the Potentiometer and replace if necessary
---	---	--

8. MIGHTY MARINER OPERATING INSTRUCTIONS

On Power Up:

- System default power to station 1, station lock is enabled
- Regardless of control head levers position, the throttle is preset to idle, and the clutch is preset to neutral, (mid position)
- Sonalert intermittent beep awaiting for operator to acknowledge control.

Operating Mode:

- Put levers in neutral position and press station select switch to acknowledge control
- Sonalert is silent
- System is ready to operate the throttle and the clutch according to lever command

Engine Warm Up

- Press Throttle Override if engine warm up is desired. Throttle Override allows you to control the throttle while the clutch is in neutral position. Levers must be in neutral to enable/disable throttle override.

Clutch Throttle Operation

- Once in normal mode, advancing the control lever from neutral to full ahead will cause the clutch to move from neutral to ahead position and a proportional throttle signal from idle to full speed
- Moving the lever from neutral to full astern will cause the clutch to move from neutral to astern position and a proportional throttle signal from idle to full speed.

Synchro Option

- Press the synchro switch if engine synchronization is desired. The system will allow one lever to control both clutches and engines synchronized.
- Both main and auxiliary control levers must be within 10% difference to allow engagement/disengagement of the synchro option.

Transferring Control to a Secondary Station

- Disable station lock at the active station
- Match the secondary station levers position to the active station levers position and press station select to transfer control
- Operate clutch/throttle as per station 1 instructions.

Transfer between stations can occur at any control lever positions; therefore, operator attention is required.

System Alarm (Sonalert):

A sonalert must be installed at least at the main station. In addition to power up indication, the sonalert will serve the following functions:

Note: You must stop the vessel and take immediate action to rectify the problem if any of the following conditions occur:

- One single beep will occur if the 6505-S control head, the 6527-S actuator or the 6503 electronics interface card DIP switches are incorrectly set. One or all control heads will become disabled. Check DIP switches and set correctly.
- Two consecutive beeps will occur if the temperature inside the 6527-S Actuator / the 6503 electronic interface card exceeds 60° C. The system will stay functional for a few more degrees. Once the temperature drops the alarm will disappear.
- Three consecutive beeps will occur if one of the actuator levers is not responding to the control lever command (actuator jam). If the clutch actuator fails the throttle will default to idle. If the throttle actuator fails the clutch will default to neutral. **The actuator will become disabled in either condition.** In the case of a twin engine system if one actuator fails, the other should remain functional.

Reset the system power in order to regain control and silence the alarm.

- Four or seven consecutive beeps will occur if the control head and the actuator or the 6503 are not communicating. **The control head will become disabled**, the system will keep the last position, the system will disable station lock and allow transfer to another station if equipped.
- Five consecutive beeps will occur if the actuator feedback pot has a broken wire. If the clutch actuator pot fails the throttle will default to idle. If the throttle actuator pot fails the clutch actuator will default to neutral. **The actuator will become disabled in either condition.** In the case of twin engine system, if one actuator fails the other should remain functional.
- Six consecutive beeps will occur if the control head pot has a broken wire. **The control head will become disabled**, the system will keep the last position, the system will disable station lock and allow transfer to another station if equipped.
- A steady alarm will occur if the control head CPU fails. (CPU locks up).
Reset the system power in order to regain control.

For more details see the troubleshooting section in the installation booklet.

9. PERIODIC SYSTEM MAINTENANCE

- Inspect system wiring:
 - Control heads wiring
 - Actuators wiring
 - 6503 Electronic interface wiring
- Inspect and monitor your primary and secondary power sources
- Inspect your push/pull cable connections between actuators and controlled devices.
- Perform a system functional test with the engines off and test system operation from all stations and for all functions available.
(See Kobelt operating instructions).

10. CONTROL HEAD CALIBRATION

All Control Heads Are Calibrated When Delivered

Recalibration Is Required Only When The Headboard or The Pot Has Been Changed In The Field

See Drawing 400931 for Jumper J2 Location

There are three calibration operations required for the Control Head unit. These can all be performed without any external equipment except a 24V power supply connected to terminals 1(V+) and 2 (V-) of P1. Calibration can be done with or without other devices connected to the CAN bus as the head produces no CAN bus signals during the calibration routine. In order to enter into the calibration process, a jumper at J2 must be installed. This both enables writes to the internal EEROM as well as causes the software to enter into the calibration routines.

Step No. 1: Pot centering

With the jumper at J2 installed and both handles in the centre indent, rotate each pot until the STATION SELECT lamp (for the left pot) and the SYNCHRO MODE lamp (for the right pot) come on. This indicates that the pot is electrically centered.

Step No. 2: Minimum offset calibration

Move both handles to full astern (towards the operator). Then press the STATION SELECT switch. The STATION LOCK lamp will come on to indicate that the offset calibration for the left hand lever was successful. Then press the SYNCHRO MODE switch and the THROTTLE OVERRIDE lamp will come on to indicate that offset calibration for the right hand lever was successful. At this time both of the inner two lamps will be illuminated.

Step No. 3: Span calibration

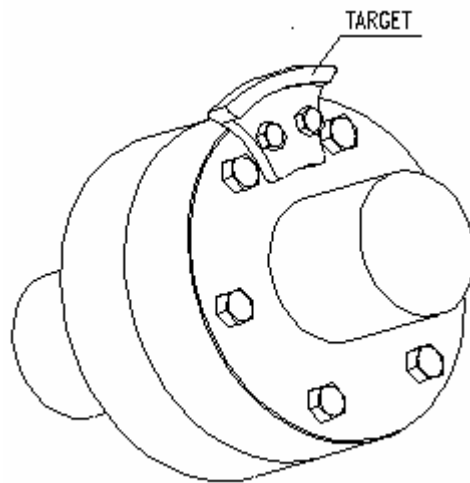
Move both handles to full ahead (away from the operator). As the handles are moved forward, the two inner lamps will turn off. Again press the STATION SELECT switch and confirm that the STATION LOCK lamp lights. Repeat the process with the SYNCHRO MODE switch and check the THROTTLE OVERRIDE lamp. As in step 2 above, both lamps indicate that the respective calibration constants were written correctly to the EEROM.

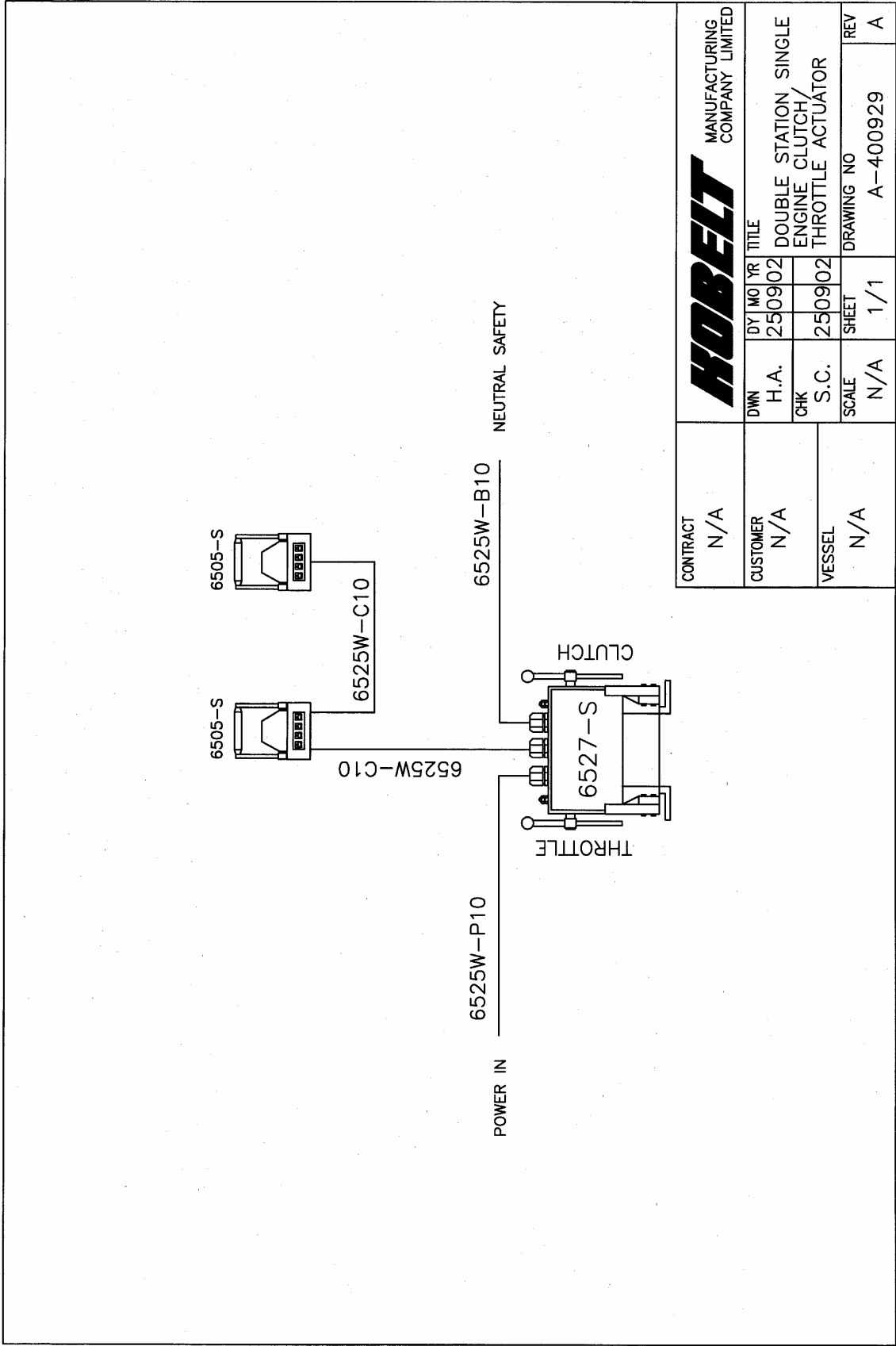
When the above steps have been completed, remove the jumper at J2 and the head will return to normal operation.

Installation Of Mechanical Pickup For Engine Synchronization And Tachometers

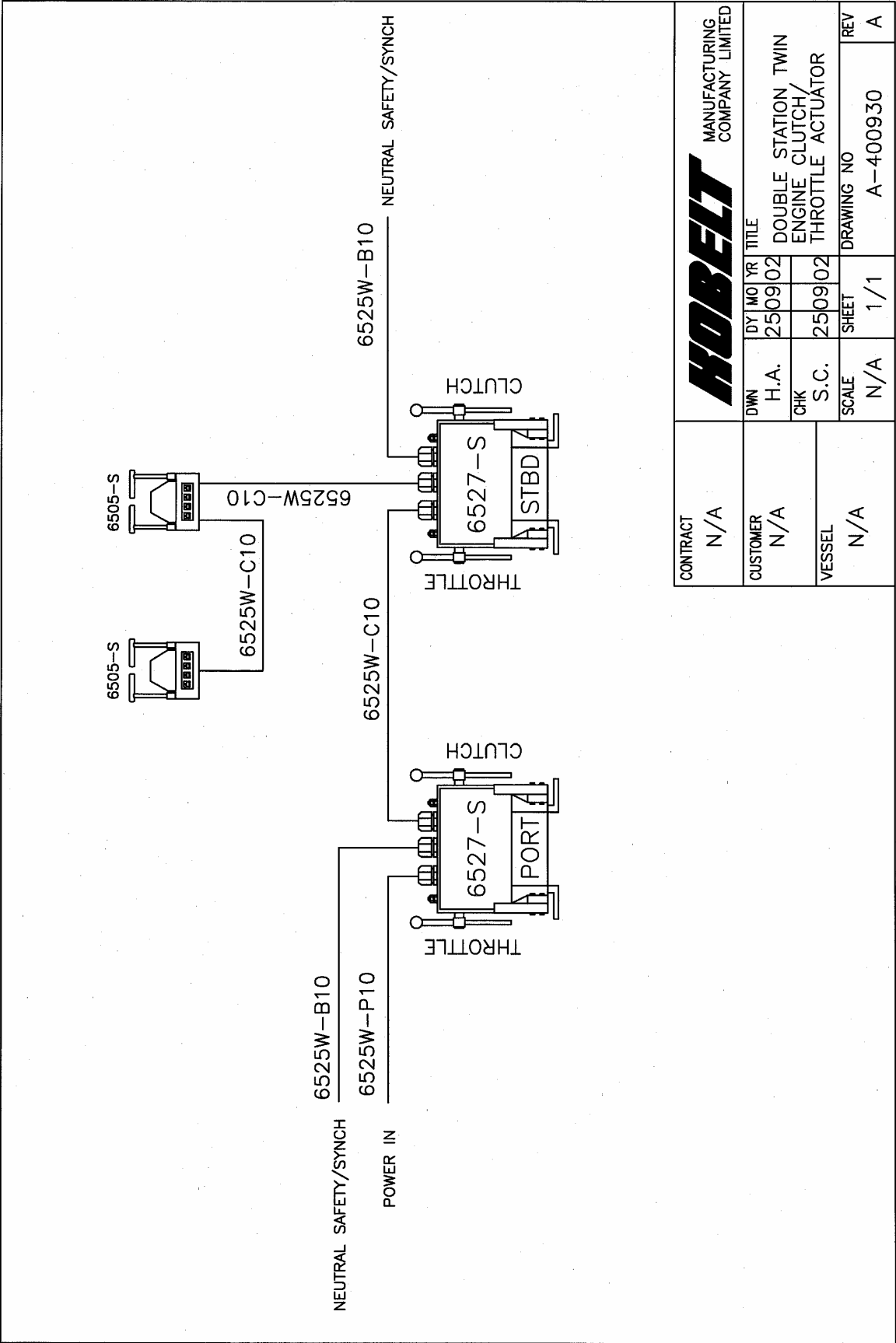
Kobelt normally supplies a Honeywell proximity sensor for this purpose. Honeywell has written some specification guidelines for this purpose but we are herewith trying to help installation and operation problems in the field.

If a mechanical pickup is installed on a rotating element, it is important to have a sufficient target so that a proximity switch can pick it up. On a fast rotating element the target must be sufficient so that the regular pulse is received. We recommend a target of approximately 2 - 3" long and 1" wide. The target must have a radius that is consistent with the centre of the axis. If the target is not consistent a double pickup might occur. The target must also be installed securely so that it does not become loose and change the intended position. The target should be a minimum of 12mm or 1/2" away from any other solid metal object in order not to receive any interference. The proximity switch must also be installed on a bracket sufficient to withstand vibration and possibly personnel stepping on it. If the proximity switch comes in contact with the rotating target it will be destroyed. A minimum clearance between the target and the proximity switch is usually approximately 1 - 2 mm or 3/32" maximum, the closer the better. It is important, however, that there is no interference between the two items. See attached sketch.

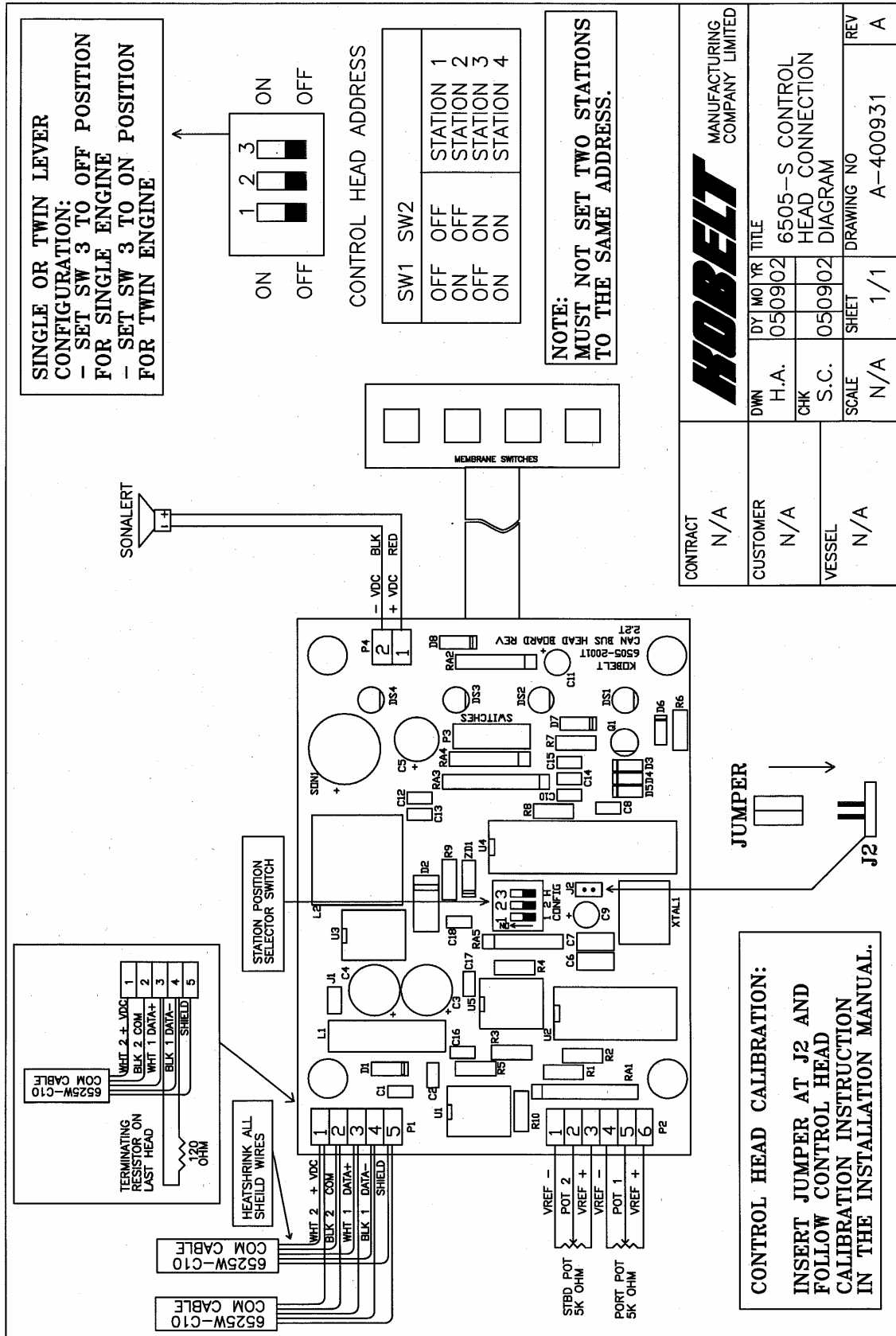


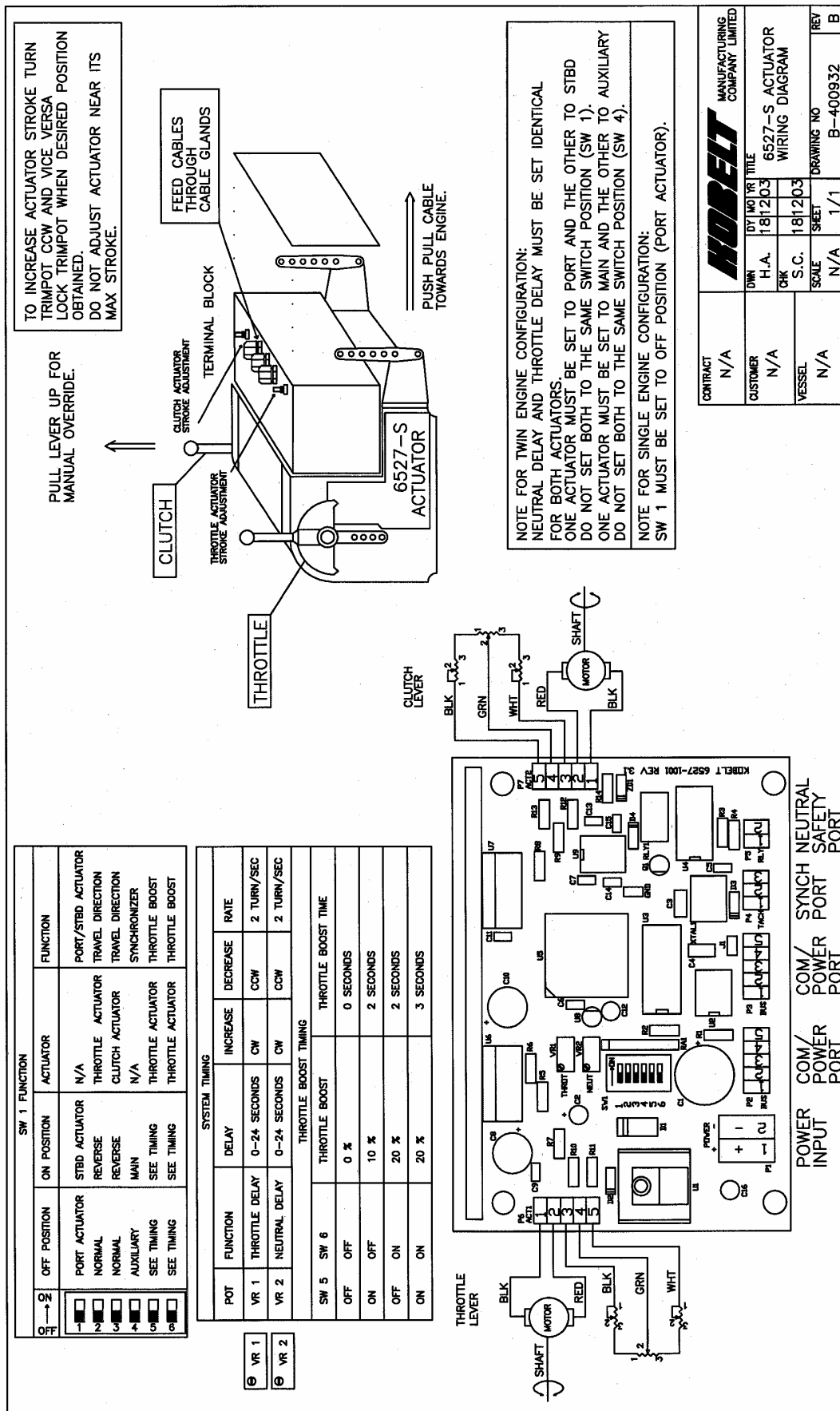


CONTRACT N/A		HOBELT MANUFACTURING COMPANY LIMITED			
CUSTOMER N/A	DWN	H.A.	DY MO YR	TITLE	
	CHK	S.C.	250902	DOUBLE STATION SINGLE ENGINE CLUTCH/THROTTLE ACTUATOR	
VESSEL N/A	SCALE N/A		SHEET	DRAWING NO	REV
			1/1	A-400929	A

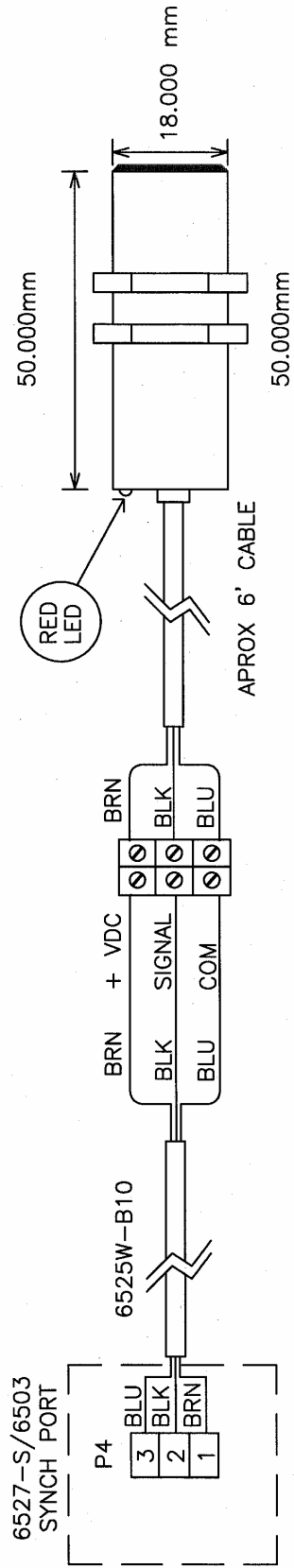


CONTRACT N/A	HOBELT MANUFACTURING COMPANY LIMITED				
	CUSTOMER N/A	DWN H.A.	DY MO YR 2509 02	TITLE DOUBLE STATION TWIN ENGINE CLUTCH/ THROTTLE ACTUATOR	
		CHK S.C.	2509 02	DRAWING NO A-400930	REV A
	VESSEL N/A	SCALE N/A	SHEET 1/1		





SYNCHRONIZER CABLE P/N 6525W-B10 7 COND. 18 AWG 10 MTR.		
SYNCH PORT	FUNCTION	WIRE COLOUR
P4-1	+ VDC SYNCH. PULSE COM	BRN
P4-2		BLK
P4-3		BLU



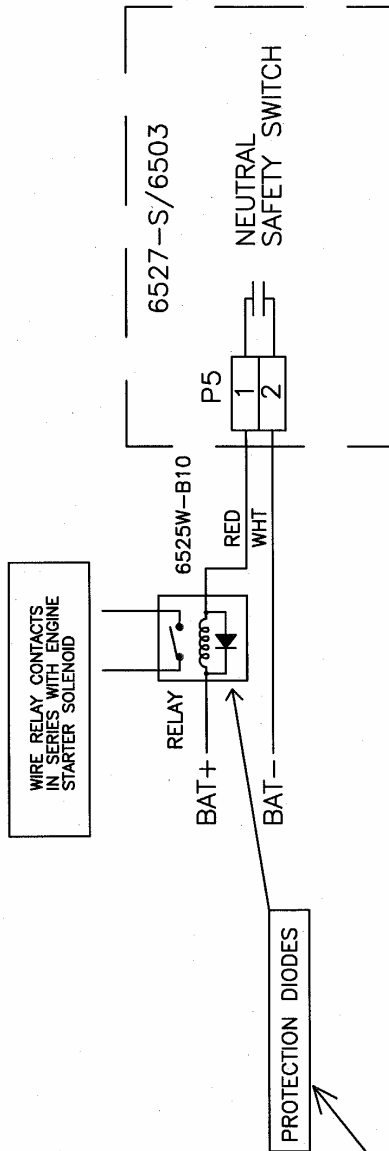
LED SHOULD FLASH IF SYNCHRO PICKUP
AND TARGET ARE INSTALLED PROPERLY.

CONTRACT N/A		HOBELT MANUFACTURING COMPANY LIMITED			
CUSTOMER N/A	DWN	H.A.	DY MO YR	TITLE	
	CHK	S.C.	050204	SYNCHRO PICK UP WIRING DIAGRAM	
VESSEL N/A	SCALE	N/A	SHEET	DRAWING NO	REV
			1/1	A-400933	B

NEUTRAL SAFETY SWITCH CABLE P/N 6525W-B10 7 COND. 18 AWG 10 MTR.		
NEUTRAL SAFETY SWITCH	FUNCTION	WIRE COLOUR
P5-1	NEUTRAL SWITCH	RED
P5-2		WHT

NEUTRAL SAFETY SWITCH OPERATION:

NEUTRAL SAFETY SWITCH WILL ONLY BE CLOSED WHEN SYSTEM IS POWERED UP AND LEVER IS IN NEUTRAL POSITION; THEREFORE, RELAY CONTACTS ARE CLOSED ALLOWING ENGINE TO START. MUST BE ABLE TO BYPASS THE NEUTRAL SAFETY SWITCHES IN ORDER TO START THE ENGINES IF THE CONTROL SYSTEM HAS FAILED.



MUST ADD PROTECTION DIODES TO REDUCE VOLTAGE SPIKES
DIODE P/N 1N4005-1N4007

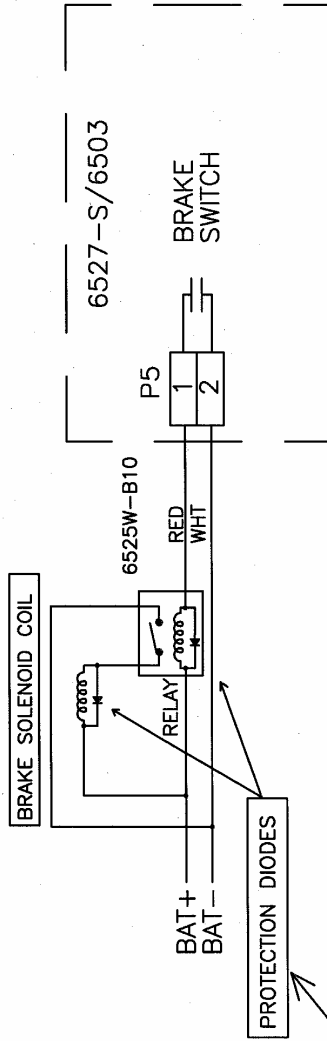
NOTE: RELAY CONTACTS MUST BE ABLE TO HANDLE STARTER SOLENOID CURRENT.
RELAY IS CUSTOMER SUPPLIED.

CONTRACT N/A	HOBELT MANUFACTURING COMPANY LIMITED			
	CUSTOMER N/A	DWN H.A.	DY MO YR 05 02 04	TITLE NEUTRAL SAFETY SWITCH WIRING DIAGRAM
	VESSEL N/A	CHK S.C.	S.C. 05 02 04	
		SCALE N/A	SHEET 1/1	DRAWING NO A-400934
				REV B

BRAKE SWITCH CABLE P/N 6525W-B10 7 COND. 18 AWG 10 MTR.		
BRAKE SWITCH	FUNCTION	WIRE COLOUR
P5-1	BRAKE SWITCH	RED
P5-2		WHT

BRAKE SWITCH OPERATION:

BRAKE SWITCH WILL ONLY BE CLOSED WHEN SYSTEM IS POWERED UP AND CLUTCH IS IN NEUTRAL POSITION; THEREFORE, RELAY CONTACTS ARE CLOSED ALLOWING BRAKE TO BE APPLIED.



MUST ADD PROTECTION DIODES TO REDUCE VOLTAGE SPIKES
DIODES P/N 1N4005-1N4007

NOTE: RELAY CONTACTS MUST BE ABLE TO HANDLE BRAKE SOLENOID CURRENT.
RELAY IS CUSTOMER SUPPLIED.

CONTRACT N/A	HOBELT MANUFACTURING COMPANY LIMITED				
	CUSTOMER	DWN	HY	MO	YR
	N/A	H.A.	05	02	04
	VESEL	CHK	S.C.	05	02
N/A		SCALE	SHEET	DRAWING NO	REV
		N/A	1/1	A-400935	B

BRAKE SWITCH WIRING DIAGRAM

CABLE SCHEDULE – ELECTRONIC ENGINE CONTROLS

POWER CABLE

P/N 6525W-P10 2 COND. 12 AWG 10 MTR.	
FUNCTION	WIRE COLOUR
VDC +	RED
COM	BLK

COMMUNICATION / POWER CABLE

P/N 6525W-C10 2 PAIR 18 AWG SHIELDED 10 MTR.	
FUNCTION	WIRE COLOUR
VDC +	WHT 2
VDC -	BLK 2
DATA +	WHT 1
DATA -	BLK 1
SHIELD	SHIELD

SYNCHRO / NEUTRAL SAFETY / BRAKE CABLE


P/N 6525W-B10 7 COND. 18 AWG 10 MTR.	
FUNCTION	WIRE COLOUR
+ VDC	BRN
SYNCH PULSE	BLK
COM	BLU
NEUT. / BRAKE N/O	RED
NEUT. /BRAKE COM	WHT
NOT USED	GRN
NOT USED	ORG

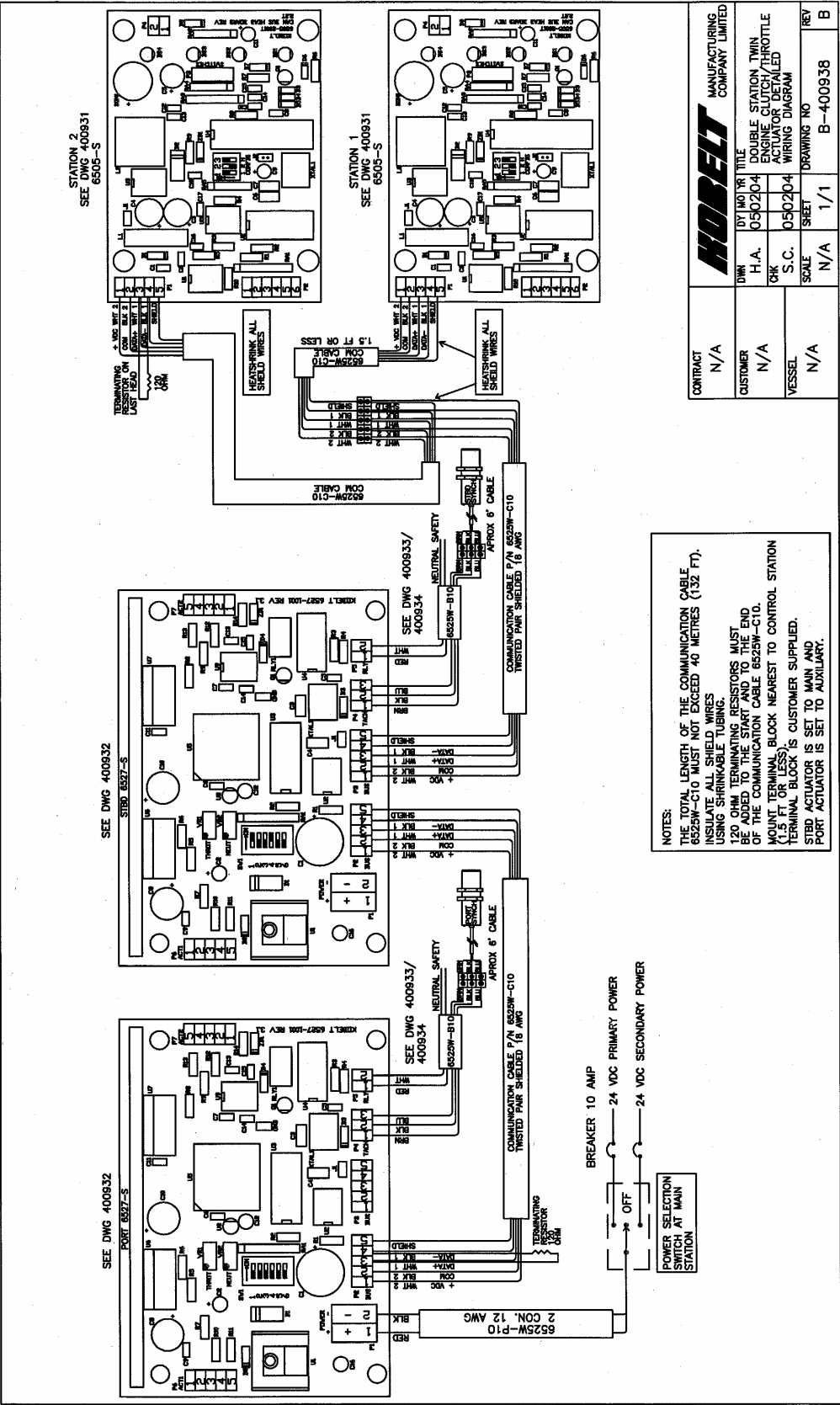
ELECTRIC CLUTCH CABLE

P/N 6525W-CT10 3 COND. 18 AWG SHIELDED 10 MTR.	
FUNCTION	WIRE COLOUR
FWD	WHT
COM	BLK
REV	RED
NOT USED	SHIELD

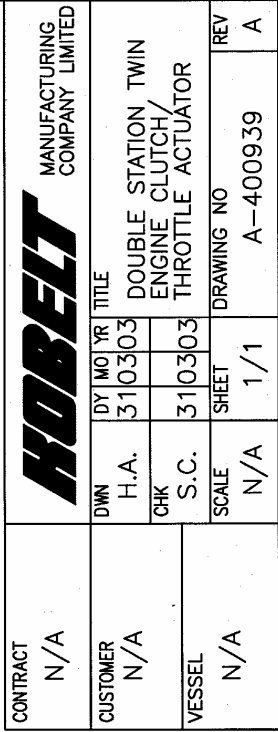
ELECTRONIC THROTTLE CABLE

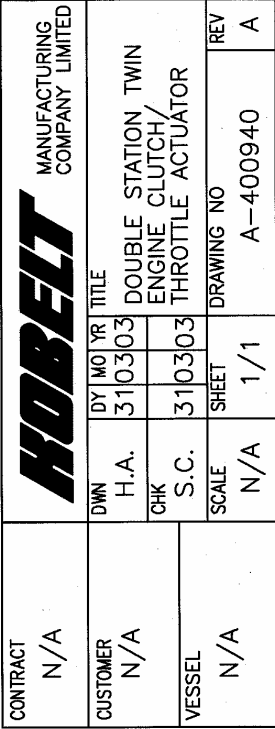
P/N 6525W-CT10 3 COND. 18 AWG SHIELDED 10 MTR.	
FUNCTION	WIRE COLOUR
THROTTLE SIGNAL	WHT
THROTTLE COM	BLK
NOT USED	RED
SHIELD	SHIELD

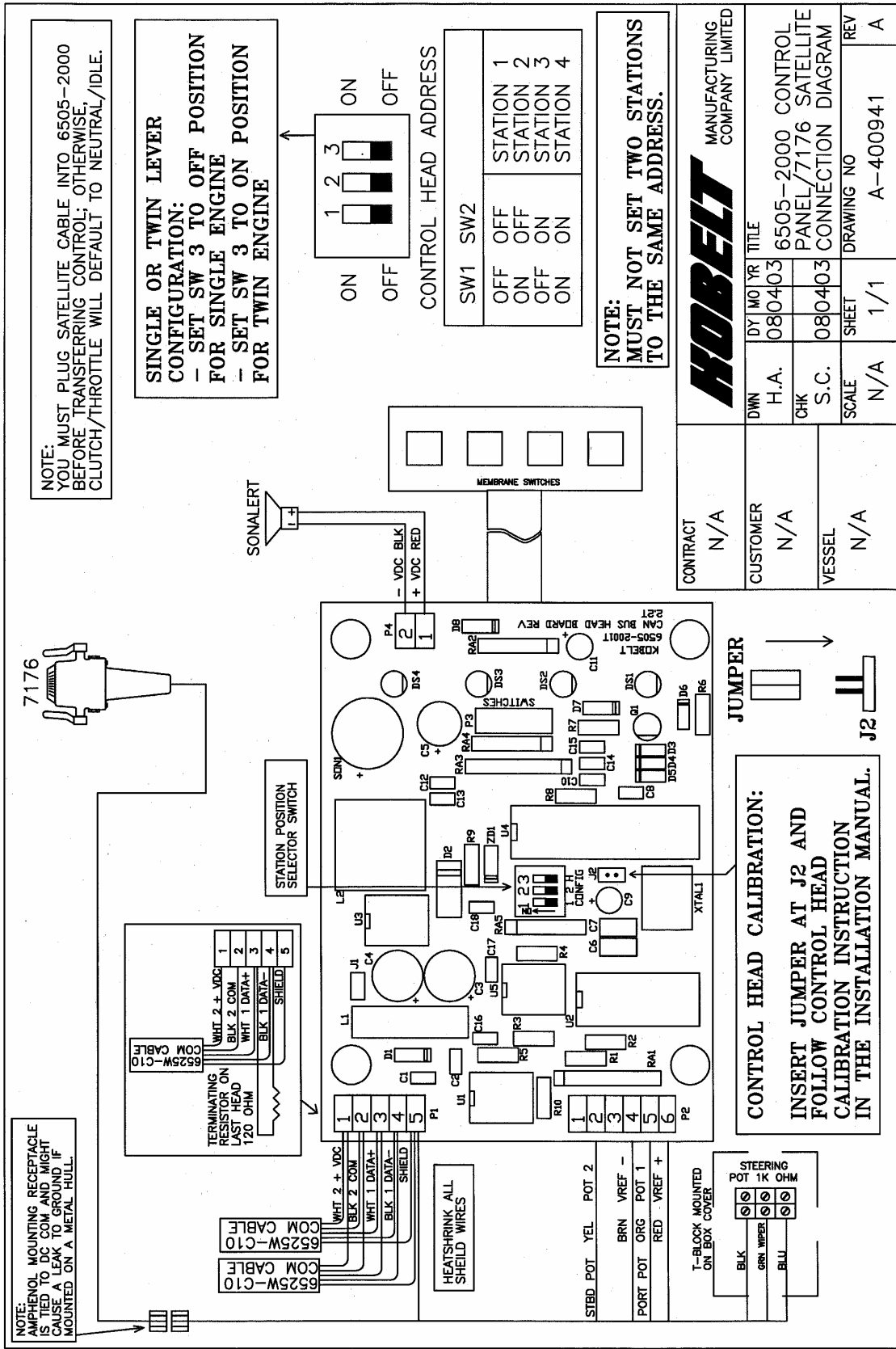
CONTRACT N/A	 MANUFACTURING COMPANY LIMITED						
CUSTOMER N/A	DWN H.A.	DY 01	MO 12	YR 03	TITLE CABLE SCHEDULE		
	CHK S.C.	01	12	03			
VESSEL N/A	SCALE N/A	SHEET 1/1		DRAWING NO A-400936		REV B	

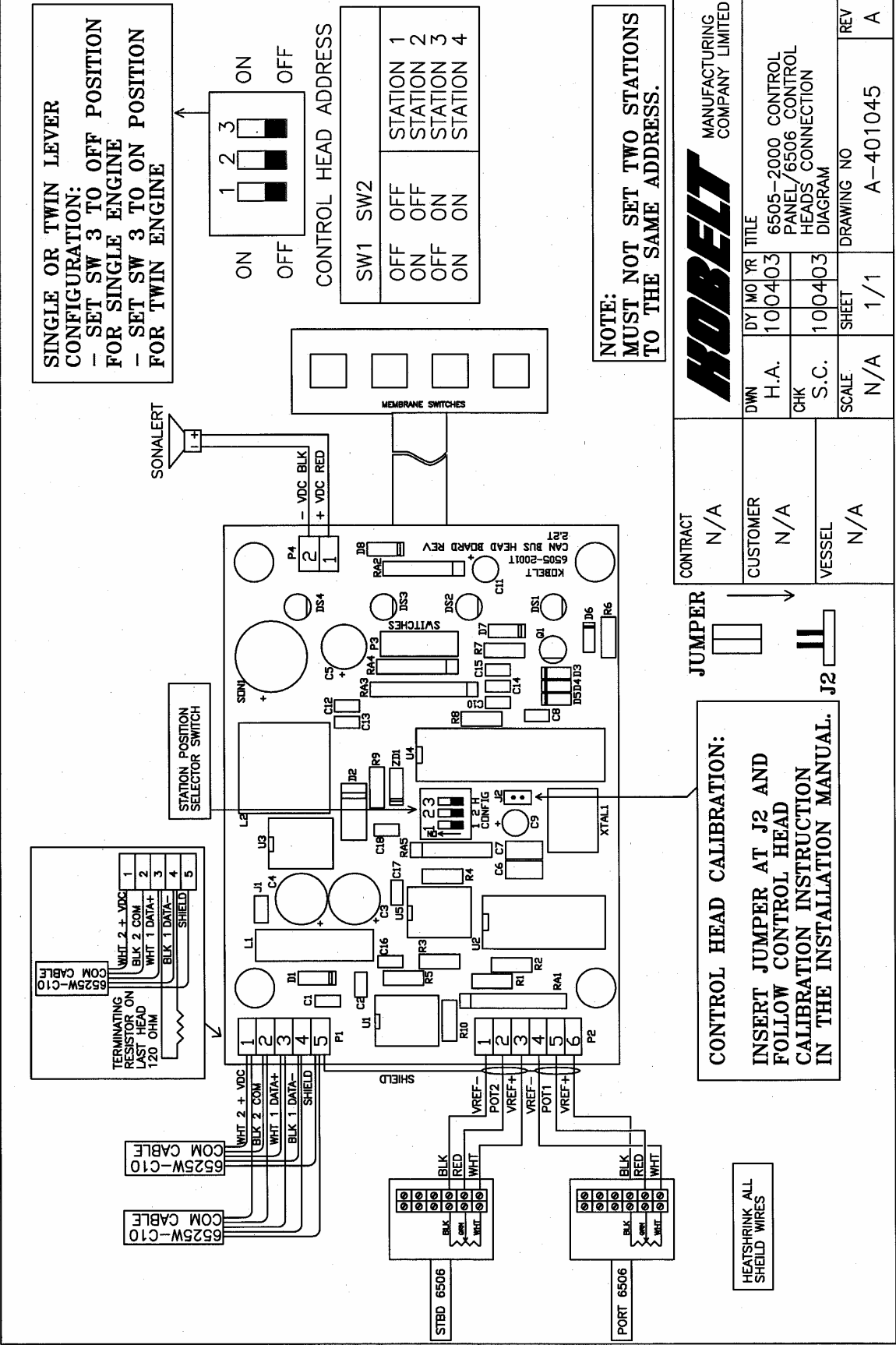


CONTRACT	N/A	HOBELT MANUFACTURING COMPANY LIMITED
CUSTOMER	DWR 071601R TITLE H.A. 050204 G&K S.C. 050204	DOUBLE STATION TWIN ENGINE SWITCH/THRUSTLE ACTUATOR DETAILED WIRING DIAGRAM
VESSEL	N/A	SCALE 1/1
DRAWING NO	N/A	B-400938
REV	B	



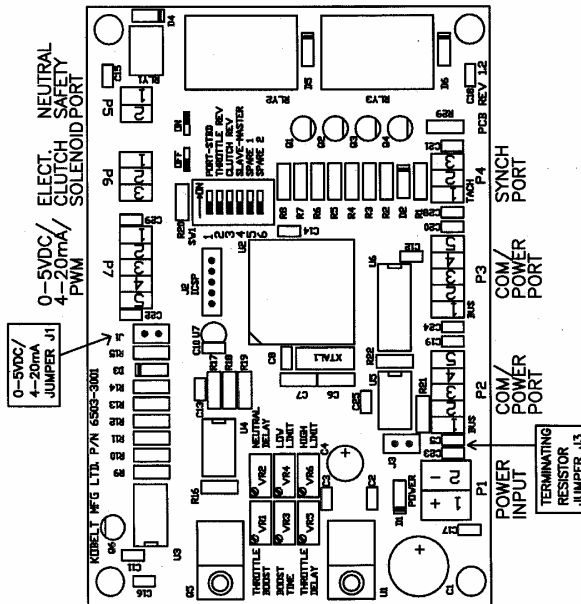






SW 1 FUNCTION			
OFF	OFF POSITION	ON POSITION	FUNCTION
1	PORT UNIT NORMAL	STBD UNIT REVERSE	PORT/STBD UNIT TRAVEL DIRECTION
2	NORMAL	REVERSE	TRAVEL DIRECTION
3	NORMAL	MAIN	SYNCHRONIZER
4	AUXILIARY	NOT USED	NOT USED
5	NOT USED	NOT USED	NOT USED
6	NOT USED	NOT USED	NOT USED

J1 & J3 JUMPER FUNCTION		
JUMPER	INSTALLED	REMOVED
J1	P7-1 & P7-2 WILL PRODUCE 0-5VDC	P7-1 & P7-2 WILL PRODUCE 4-20mA
J3	120 OHM TERMINATING RESISTOR INSTALLED	NO TERMINATING RESISTOR

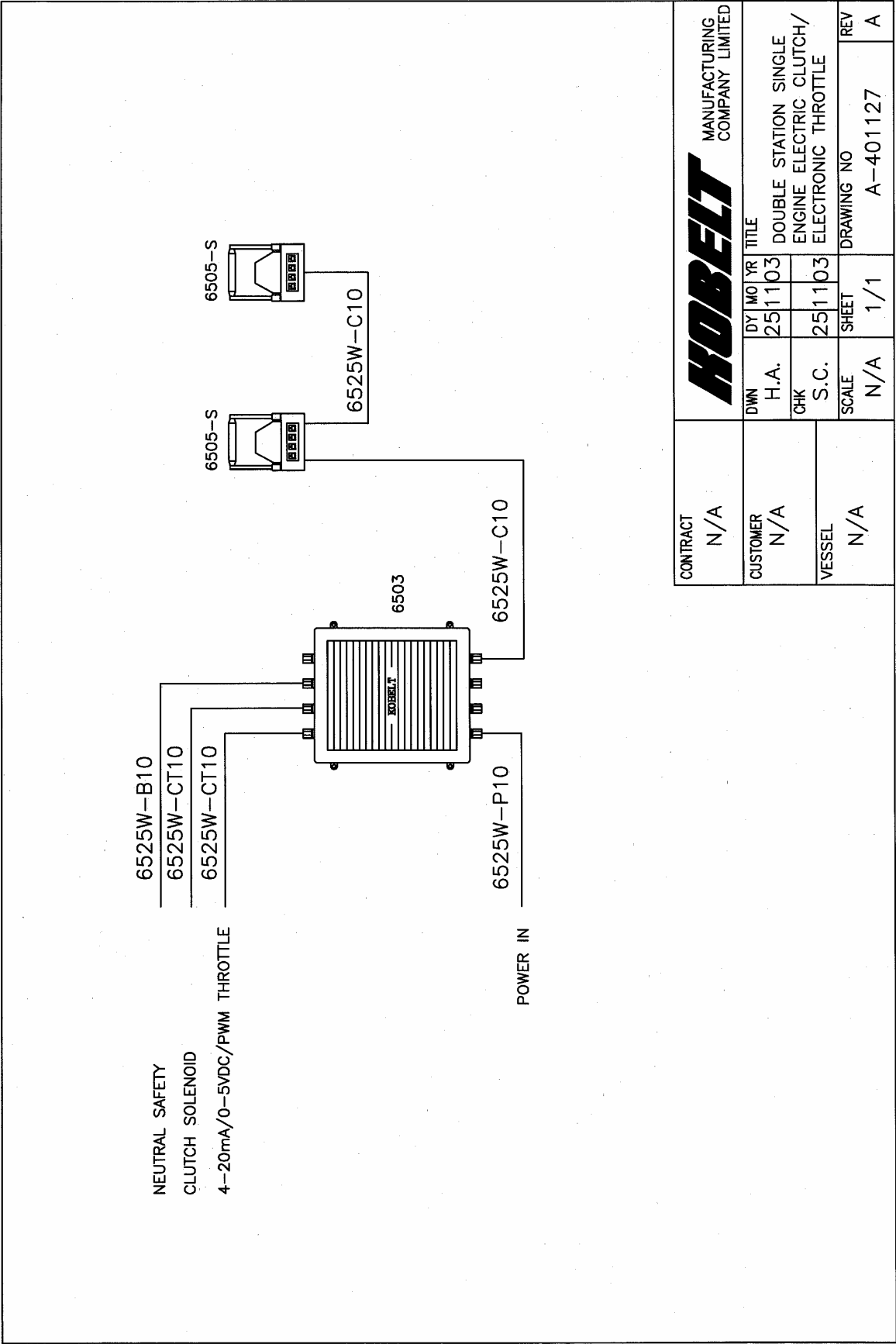


SYSTEM TIMING				
POT	FUNCTION	DELAY/% THROTTLE	INCREASE	DECREASE
VR 5	THROTTLE DELAY	0-24 SECONDS	CW	CCW
VR 2	NEUTRAL DELAY	0-24 SECONDS	CW	CCW
VR 1	THROTTLE BOOST	0%-25% THROTTLE	CW	CCW
VR 3	THROTTLE BOOST TIME	0-5 SECONDS	CW	CCW

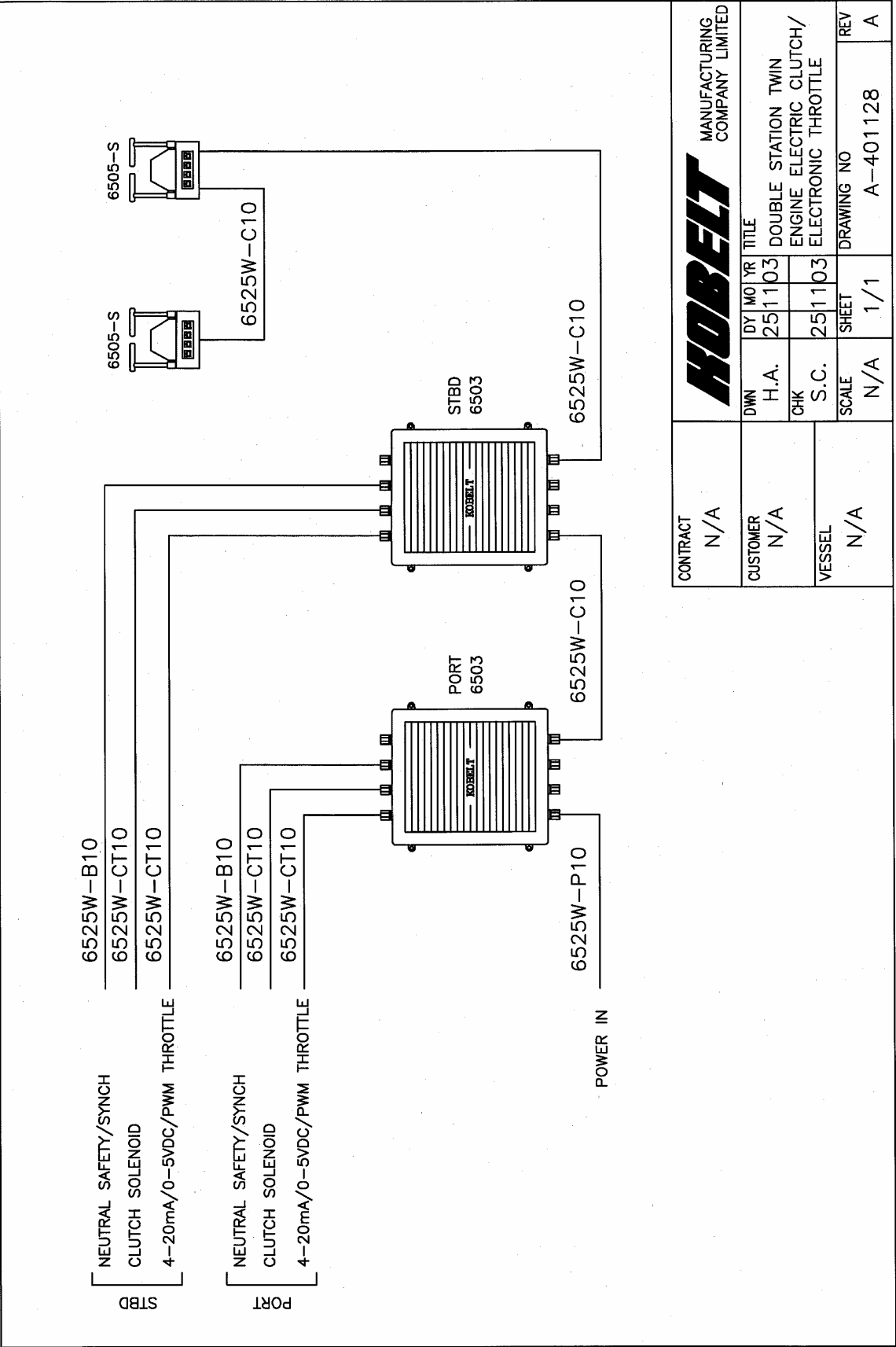
ELECTRONIC THROTTLE OUTPUT ADJUSTMENT				
POT	FUNCTION	% THROTTLE SIGNAL	INCREASE	DECREASE
VR 4	LOW LIMIT ADJUST	0% - 40% THROTTLE SIGNAL	CW	CCW
VR 6	HIGH LIMIT ADJUST	60% - 100% THROTTLE SIGNAL	CW	CCW

NOTE FOR TWIN ENGINE CONFIGURATION:
NEUTRAL DELAY AND THROTTLE DELAY MUST BE SET IDENTICAL FOR BOTH CARDS.
ONE CARD MUST BE SET TO PORT AND THE OTHER TO STBD DO NOT SET BOTH TO THE SAME SWITCH POSITION (SW 1).
ONE CARD MUST BE SET TO MAIN AND THE OTHER TO AUXILIARY DO NOT SET BOTH TO THE SAME SWITCH POSITION (SW 4).
NOTE FOR SINGLE ENGINE CONFIGURATION:
SW 1 MUST BE SET TO OFF POSITION (PORT UNIT).
SWITCHES 5 AND 6 ARE NOT BEING USED AND MUST BE SET TO OFF POSITION.
NOTE: REVERSING THE ENGINE SIGNAL MIGHT CAUSE DAMAGE TO THE CLUTCH. EXTREME CAUTION IS REQUIRED.

CONTRACT	N/A	MANUFACTURING COMPANY LIMITED
CUSTOMER	N/A	6503-3001 ELECTRONIC INTERFACE CARD SYSTEM ADJUSTMENT
VESEL	N/A	SCALE SHEET
DRAWING NO	N/A	1/1
REV	N/A	B-401126
A		



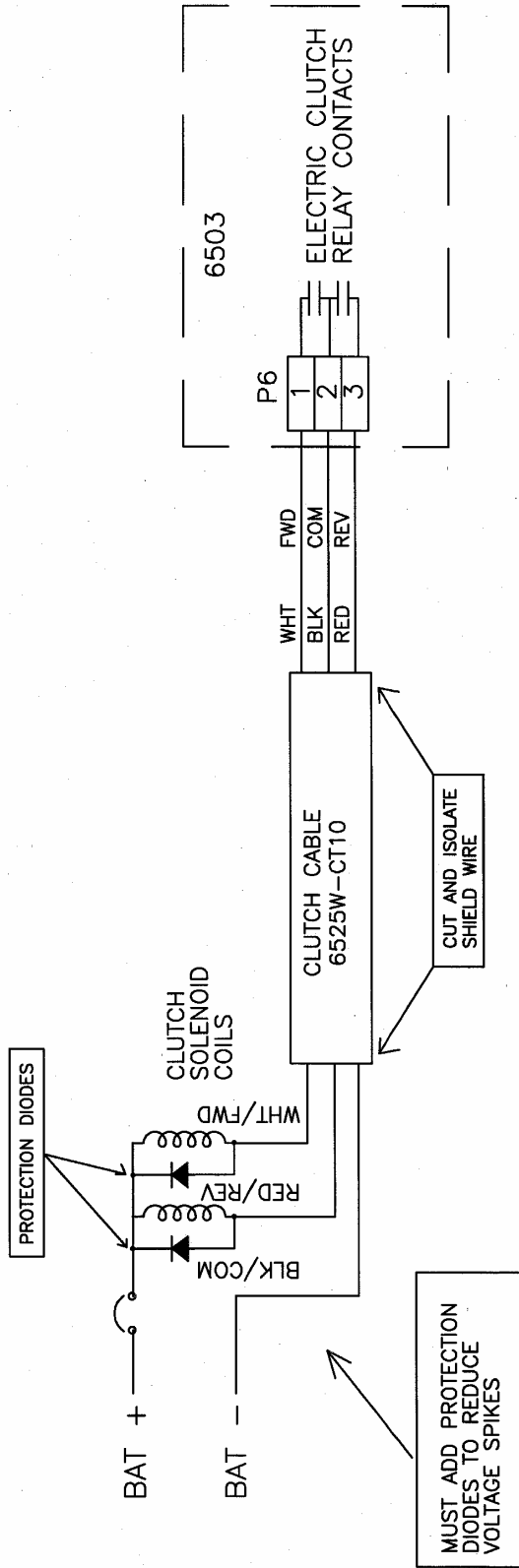
CONTRACT N/A		HOBELT MANUFACTURING COMPANY LIMITED					
CUSTOMER N/A	DWN	H.A.	DY	MO	YR	TITLE	
	CHK	S.C.	25	11	03	DOUBLE STATION SINGLE ENGINE ELECTRIC CLUTCH/ ELECTRONIC THROTTLE	
VESSEL N/A	SCALE	N/A	SHEET		DRAWING NO		REV
			1/1		A-401127		A



CONTRACT N/A	HOBELT MANUFACTURING COMPANY LIMITED				
	CUSTOMER N/A	DWN H.A.	DY MO YR 25 11 03	TITLE DOUBLE STATION TWIN ENGINE ELECTRIC CLUTCH/ELECTRONIC THROTTLE	
	VESSEL N/A	CHK S.C.	25 11 03	DRAWING NO A-401128	REV A
		SCALE N/A	SHEET 1/1		

ELECTRIC CLUTCH CABLE P/N 6525W-CT10 3 COND. 18 AWG 10 MTR.		
6503 ELECTRIC CLUTCH	FUNCTION	WIRE COLOUR
P6-1	FORWARD SIGNAL	WHT
P6-2	COM	BLK
P6-3	REVERSE SIGNAL	RED
	NOT USED	SHIELD

NOTE ABOUT CLUTCH SOLENOIDS:
CLUTCH SOLENOIDS COULD BE WIRED
TO SWITCH POSITIVE INSTEAD OF SWITCHING
TO GROUND, IF SO REVERSE PROTECTION
DIODES.
MUST ADD PROTECTION DIODES TO THE
SOLENOID COILS TO REDUCE VOLTAGE SPIKES.
PROTECTION DIODE P/N 1N4005-1N4007



CONTRACT N/A		HOBELT MANUFACTURING COMPANY LIMITED	
CUSTOMER N/A	DWN H.A.	DY MO YR 271103	TITLE 6503 ELECTRIC CLUTCH OUTPUT PORT DETAILED WIRING DIAGRAM
	CHK S.C.	271103	
VESSEL N/A	SCALE N/A	SHEET 1/1	DRAWING NO A-401131
			REV A

