MIGHTY MARINER

ENGINE CONTROLS

INSTALLATION MANUAL

August 2013

ELECTRONIC ENGINE CONTROLS (MM)
INSTALLATION INSTRUCTIONS

Table of Contents

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: 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.

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.

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 Picprocessor 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. *See drawing 400932.*

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 Picprocessor circuitry. All the system adjustments can be maintained through adjustable trimpots and DIP switches. See drawing 401126

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, 0-5 VDC 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 (6505s / 6505-2000)

Interacting With The Actuator

The Station Control Heads let the operator interact with the Actuator /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

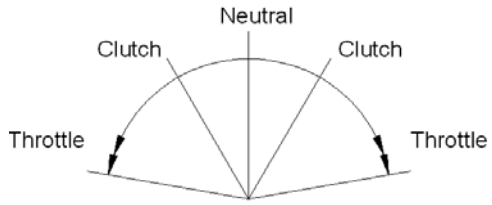
The Station Control Heads are waterproof from the top side only and capable of withstanding wet weather conditions and can be supplied with a chrome, white, bronze or black epoxy finish.

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.

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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*

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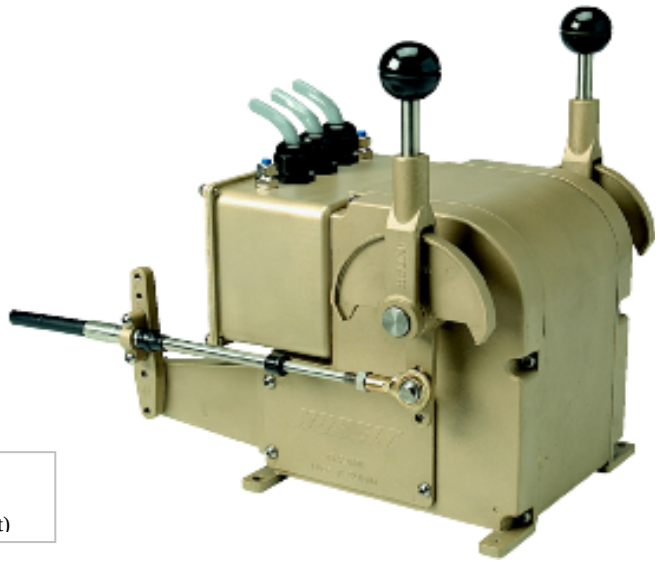


Picture shows 6527-S actuator with cable (not included in standard unit)

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.

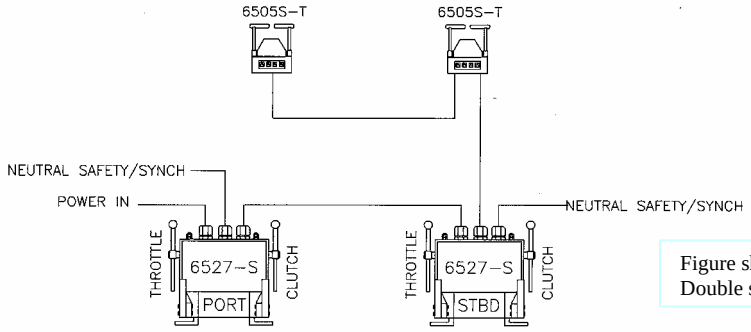
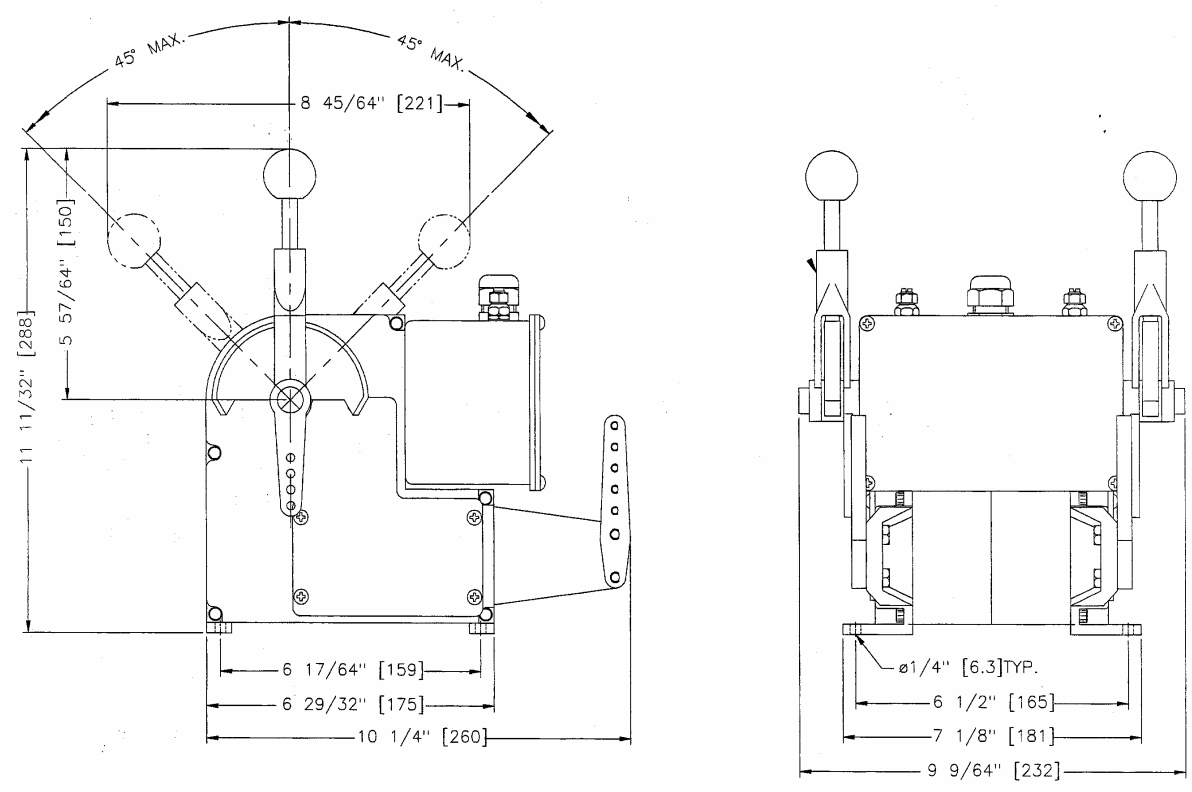


Figure shows typical configuration for Double station Twin engine system

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

MODEL 6527-S


45° MAX.
45° MAX.
8 45/64" [221]
5 57/64" [150]
11 11/32" [288]
6 17/64" [159]
6 29/32" [175]
10 1/4" [260]
ø1/4" [6.3]TYP.
6 1/2" [165]
7 1/8" [181]
9 9/64" [232]

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MODEL 6506 SIDE MOUNT CONTROL

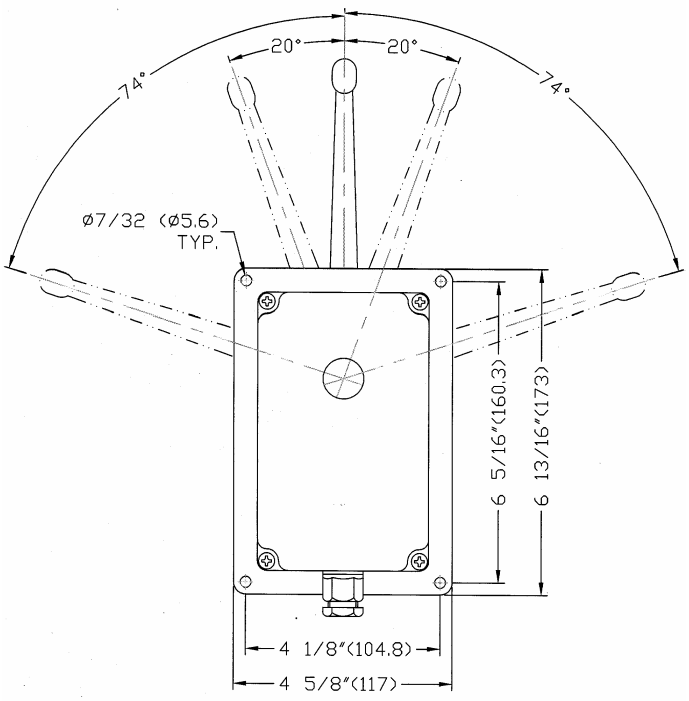
The 6506 is a side mounting electronic control which can be used for single lever clutch and throttle or any combination of CP propeller and/or trolling valve. This unit is constructed in bronze and stainless steel and the housing is available in chrome and/or black epoxy, (the control handle is always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

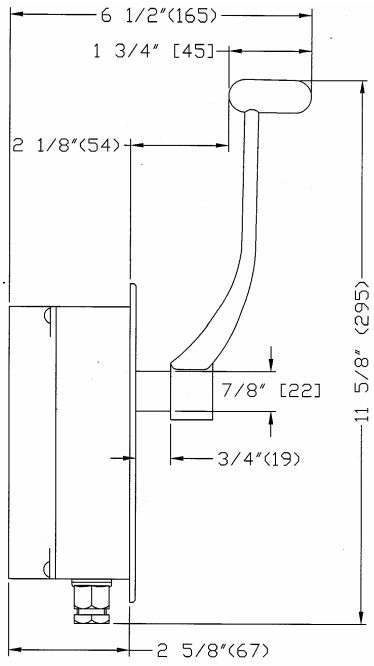
The handle is attached to the control on a 36 tooth spline and can, therefore, be rotated in 10º increments to suit the installation.

The control can be installed in two different ways. An external flush mounting (housing is exposed) or an internal mounting whereby the housing is behind the control console and only the lever and shaft is exposed. The unit is equipped with friction and detent and can be adjusted to suit customer requirement.

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

MODEL 6506





All dimensions in inches (mm)

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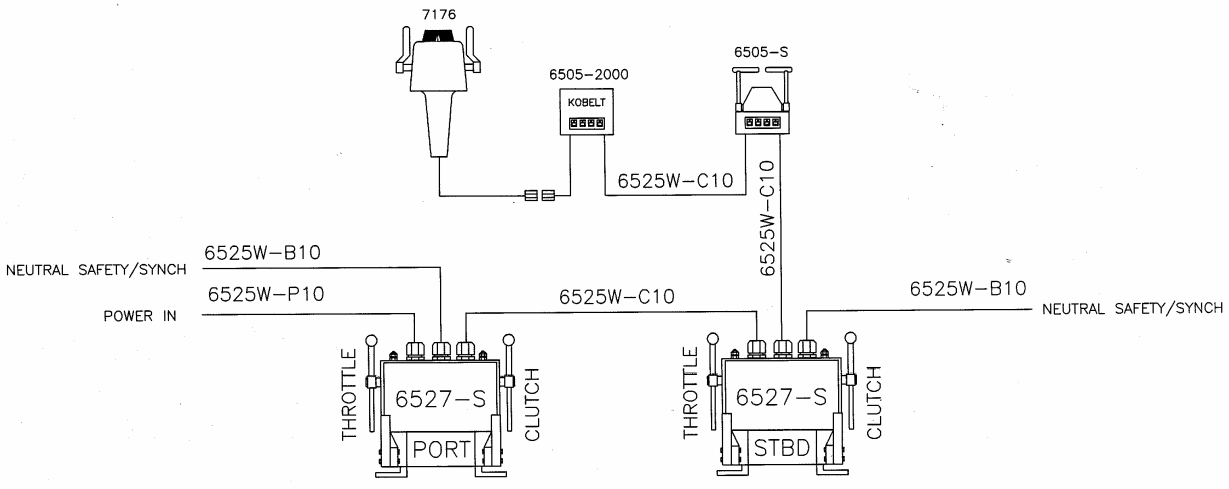
MODEL 6505-2000
REMOTE SELECTOR PANEL

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)

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. Clean power sources must be provided.

3.2 ELECTRIC 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 must be provided, a primary source and a secondary source. A three position switch capable of handling the 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 / 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 (6505S / 6505-2000)

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

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.

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

Mounting Bracket

The Actuator's Mounting Bracket should be flat to avoid distortion of the Actuator housing.

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.

Electrical Connections

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.

WARNING: Do not coil up excess cable.

Check The Diagrams

Check the appropriate wiring diagram for the Actuator. The cable specification and wiring diagrams are at the back of this manual.

NOTE: Care must be taken with connections made at the Actuator. Improper wiring connections may result in damage to the Actuator.

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 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^{o} to $+55^{o}$ 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

The throttle output can be selected to provide a 4 to 20mA, 0 to 5VDC or a PWM signal for electronic governor systems. One output will be selected during the installation.

See drawing 401132

Throttle Movement

The standard throttle produces Minimum signal for idle RPM and Maximum signal for full RPM. For example, 4mA is equal to idle speed and 20 mA is equal to full speed.

Electrical Reversal

If the electronic signal is reversed to what is desired, it can be electrically reversed by setting DIP switches.

See drawing 401126

NOTE: Reversing the engine signal might cause damage to the clutch. Extreme caution is required.

Throttle Cable

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.

NOTE: The red wire is not used and must be cut and isolated. The shield must not be connected to the engine side.

See drawing 401132

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 metres (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

See drawing 401132

Synchronizer Cables

The Synchronizer cable is 7 conductor #18 AWG.

See drawing 400933

Clutch Cable

The clutch cable is 3 conductor #18 AWG

See drawing 401131

Shaft Brake/ Neutral Safety Cable

The Shaft Brake/Neutral Safety Cable is 7 conductor #18 AWG.

See drawing 400934 / 400935

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" (1.4 mm). If stainless steel is used for a target, the maximum sensing gap will be approximately 0.035" (1 mm).

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

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3. 8 SHAFT BRAKE/NEUTRAL SAFETY OUTPUT

Operation The Shaft Brake Output features a set of normally open contacts: These 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

Inspect system wiring:

- Control heads wiring
- Actuators wiring
- 6503 Electronic card wiring

Inspect and monitor your primary and secondary power sources.

Inspect your push/pull cable connections between actuators and controlled devices. Check cable clamp screws and make sure they are tight.

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)

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 indicate that the transfer has been completed. 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 press 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

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5 INSTALLATION CHECKLIST

5. 1 GENERAL

- ☐ ENGINE EMERGENCY STOPS must be installed at every station
- ☐ The primary and secondary power sources 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 (6505S / 6505-2000)

☐ 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

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6. SYSTEM SETUP AND TEST PROCEDURES

Pre-Test Check

- 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	• Disconnect the PUSH/PULL cables or mechanical linkage from all Actuators • Unplug P6 and P7 from the 6503 electronic interface card
Power Up	• 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	• 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	• Move the Control Head levers and observe whether the actuators are responding to the lever commands
6527-S Throttle/Clutch	• 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, *see drawing 400932* • Determine the stroke required for Clutch and Throttle. Make any *coarse* adjustments by moving the cable connection up or down on the Actuator lever. Make any *fine* adjustments by turning the Actuator trimpots to obtain the desired position.
6527-S PUSH/PULL Cables	• With the engine shut down, connect the PUSH/PULL cables to the actuators and fine tune for best results.
6503 Levers	With 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 is 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

- Once signal calibration is complete and with the engine shut down, connect the clutch and the throttle cables to the 6503 electronic interface.

Throttle Delay

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

see drawings 400932 / 401126

Neutral Delay

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

see drawings 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	• The power is off • The polarity is reversed on the DC power input	• Turn the power on • Reverse the connections
There is a continuous sonalert beep	• Control Head CPU hangs up	• Reset system
The system is not synchronizing	• The synchronizer is not set properly • There is a problem with the synchronizer wiring • Parts are having different software revisions	• 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	• There is a ground loop	• Check and make sure the cable shields are isolated
<u>One (1) Single Beep</u> The Control Head will become disabled All control heads will become disabled	• The 6505S Control Head DIP switches are incorrectly set • The 6527-S Actuator or the 6503 interface card DIP switches are incorrectly set	• Check the DIP switches setting of the 6505S Control Head, 6527-S Actuator or the 6503 Interface card
<u>Two (2) Consecutive Beeps</u>	• System temperature is above 60˚C	• Must provide ventilation

Three (3) Consecutive Beeps 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.	• The Actuator is jammed • The Actuator motor has failed.	• Check the push pull cable • Check the wiring and the motor
Four (4) or Seven (7) Beeps The control head will become disabled. Station Lock will be disabled. Control can be transferred to other stations if equipped	• One or more communication wires are missing • One or more terminating resistors are missing	• Check the wiring • Install terminating resistors
Five (5) Consecutive Beeps 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.	• The Actuator potentiometer is damaged. • One or more of the Pot wires are broken.	• Check the Potentiometer and replace if necessary.
Six (6) Consecutive Beeps The Control Head will become disabled Station Lock will be disabled Control can be transferred to other stations if equipped	• The Control Head potentiometer is damaged • One or more of the Control Head pot wires are broken	• 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 the immediate action to rectify the problem if any of the following conditions occur:

- One single beep will occur if the 6505S 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 electronics 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 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 centred.

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 the 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.

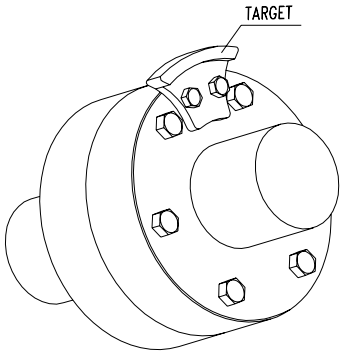
When the above steps have been completed, remove the jumper at J2 and the head will return to normal operation.

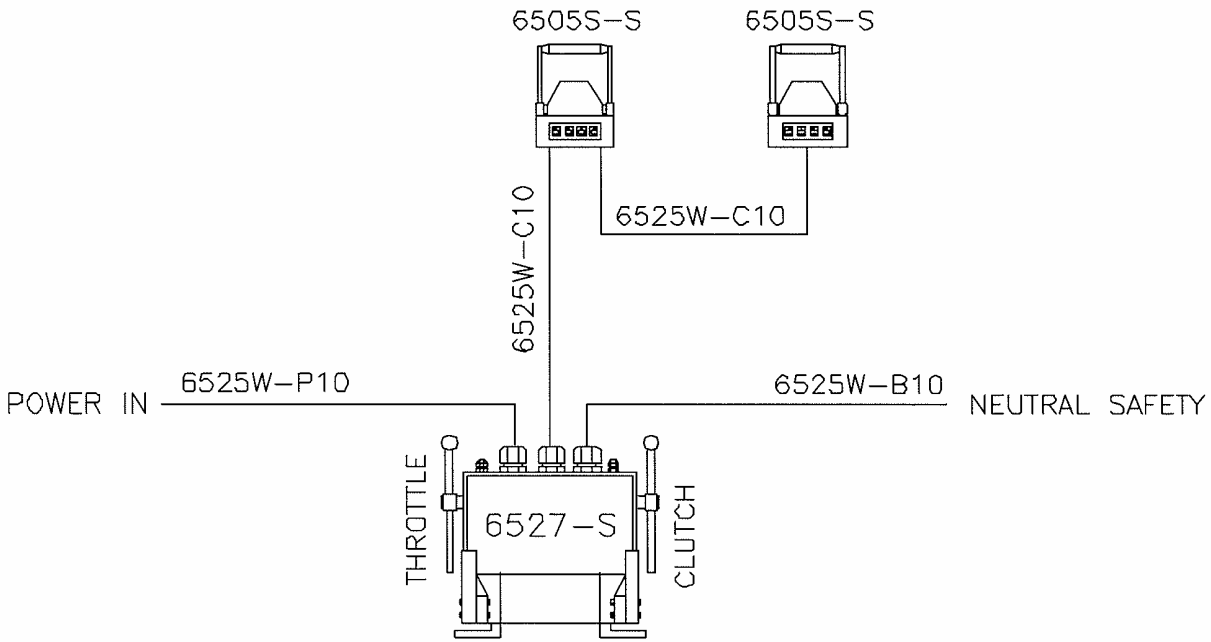
Installation Of Mechanical Pickup For Engine Synchronization And Tachometers

Kobelt normally supplies a Pepperl+Fuchs proximity sensor for this purpose. P+F has written some

specification guidelines for this purpose but we are herewith trying to help installation and operation problems in the field.

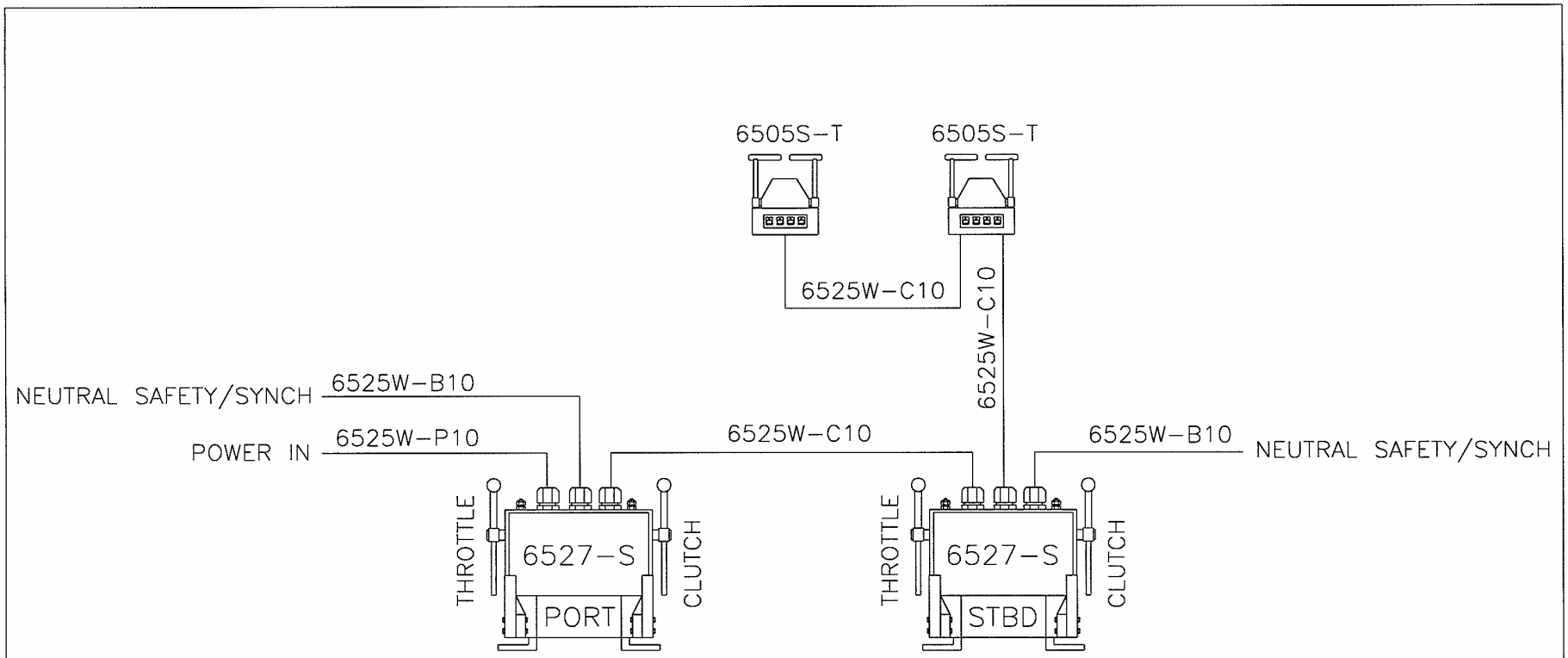
If a mechanical pickup is installed on a rotating element, it is important to have a sufficient target so that a proximity switch can pick it up. On a fast rotating element the target must be sufficient so that the regular pulse is received. We recommend a target of approximately 2 - 3" long and 1" wide. 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 ½" 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 the 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 sketch below.





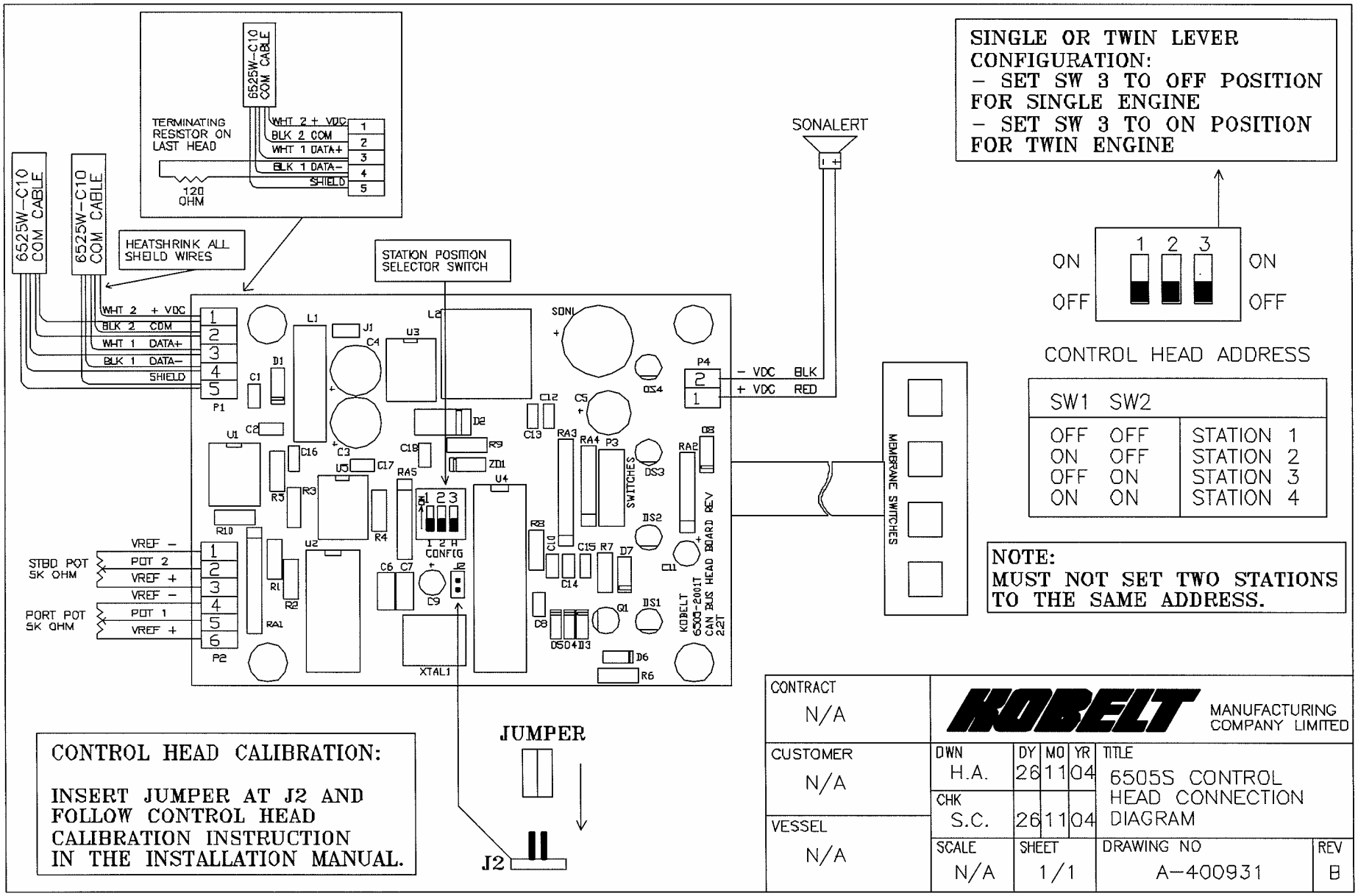
CONTRACT N/A	KOBELT MANUFACTURING COMPANY LIMITED					
CUSTOMER N/A	DWN H.A.	DY 26	MO 11	YR 04	TITLE DOUBLE STATION SINGLE ENGINE CLUTCH/ THROTTLE ACTUATOR	
VESSEL N/A	CHK S.C.	26	11	04		
	SCALE N/A	SHEET 1/1			DRAWING NO A-400929	REV B

Drawing 400929



CONTRACT N/A	KOBELT MANUFACTURING COMPANY LIMITED					
CUSTOMER N/A	DWN H.A.	DY 26	MO 11	YR 04	TITLE DOUBLE STATION TWIN ENGINE CLUTCH/ THROTTLE ACTUATOR	
VESSEL N/A	CHK S.C.	26	11	04		
	SCALE N/A	SHEET 1/1			DRAWING NO A-400930	REV B

Drawing 400930



Drawing 400931

SW 1 FUNCTION				
OFF → ON	OFF POSITION	ON POSITION	ACTUATOR	FUNCTION
1	PORT ACTUATOR	STBD ACTUATOR	N/A	PORT/STBD ACTUATOR
2	NORMAL	REVERSE	THROTTLE ACTUATOR	TRAVEL DIRECTION
3	NORMAL	REVERSE	CLUTCH ACTUATOR	TRAVEL DIRECTION
4	AUXILIARY	MAIN	N/A	SYNCHRONIZER
5	SEE TIMING	SEE TIMING	THROTTLE ACTUATOR	THROTTLE BOOST
6	SEE TIMING	SEE TIMING	THROTTLE ACTUATOR	THROTTLE BOOST

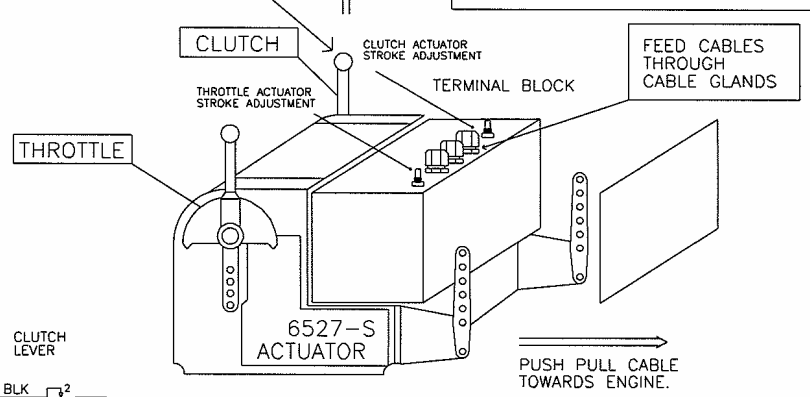
NOTE: MUST SET THE CLUTCH ACTUATOR STROKE ACCURATELY; OTHERWISE, THE THROTTLE ACTUATOR WILL NOT RESPOND. THE CLUTCH MOTOR MUST STOP RUNNING WHEN THE CORRECT STROKE IS OBTAINED. RE-ADJUST STROKE IF MOTOR IS STILL TRYING TO ROTATE (MOTOR HUMMING).

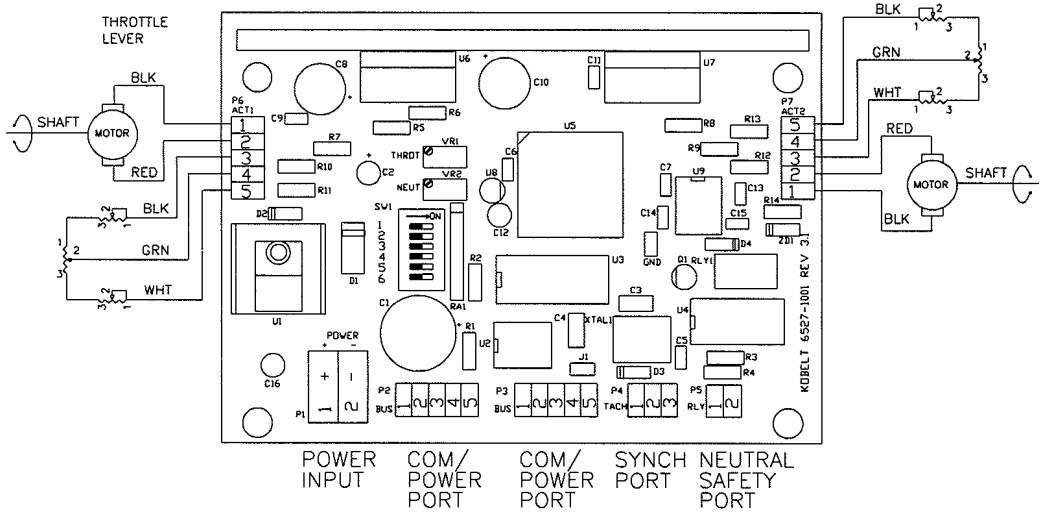
PULL LEVER UP FOR MANUAL OVERRIDE.

TO INCREASE ACTUATOR STROKE TURN TRIMPOT CCW AND VICE VERSA
LOCK TRIMPOT WHEN DESIRED POSITION OBTAINED.
DO NOT ADJUST ACTUATOR NEAR ITS MAX STROKE.
MUST ADJUST THE STROKE ACCURATELY TO PREVENT THE ACTUATOR FROM ALARMING.

SYSTEM TIMING					
POT	FUNCTION	DELAY	INCREASE	DECREASE	RATE
VR 1	THROTTLE DELAY	0-24 SECONDS	CW	CCW	2 TURN/SEC
VR 2	NEUTRAL DELAY	0-24 SECONDS	CW	CCW	2 TURN/SEC

THROTTLE BOOST TIMING			
SW 5	SW 6	THROTTLE BOOST	THROTTLE BOOST TIME
OFF	OFF	0 %	0 SECONDS
ON	OFF	10 %	2 SECONDS
OFF	ON	20 %	2 SECONDS
ON	ON	20 %	3 SECONDS





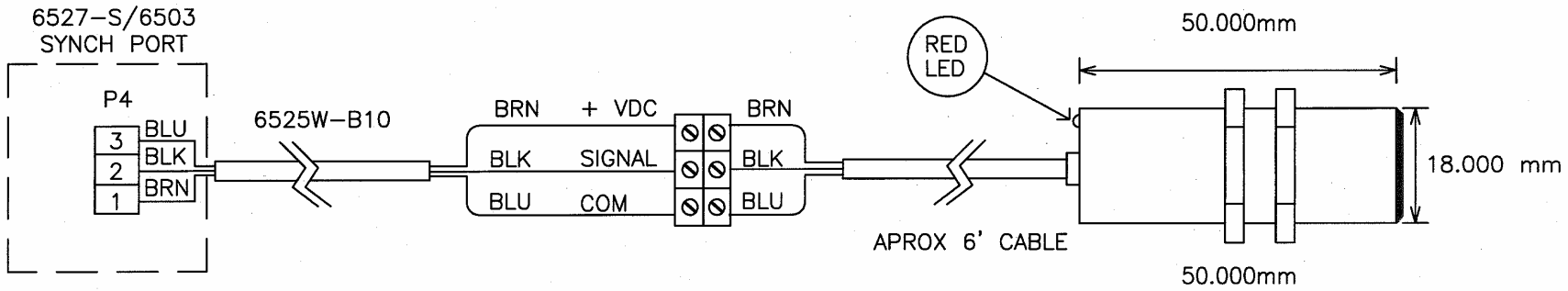
NOTE FOR TWIN ENGINE CONFIGURATION:
NEUTRAL DELAY AND THROTTLE DELAY MUST BE SET IDENTICAL FOR BOTH ACTUATORS.
ONE ACTUATOR MUST BE SET TO PORT AND THE OTHER TO STBD
DO NOT SET BOTH TO THE SAME SWITCH POSITION (SW 1).
ONE ACTUATOR MUST BE SET TO MAIN AND THE OTHER TO AUXILIARY
DO NOT SET BOTH TO THE SAME SWITCH POSITION (SW 4).

NOTE FOR SINGLE ENGINE CONFIGURATION:
SW 1 MUST BE SET TO OFF POSITION (PORT ACTUATOR).

CONTRACT N/A	KOBELT MANUFACTURING COMPANY LIMITED				
CUSTOMER N/A	DWN H.A.	DY 16	MO 08	YR 13	TITLE 6527-S ACTUATOR WIRING DIAGRAM
VESSEL N/A	CHK S.C.	16	08	13	
	SCALE N/A	SHEET 1/1	DRAWING NO B-400932		REV D

Drawing 400932

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



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

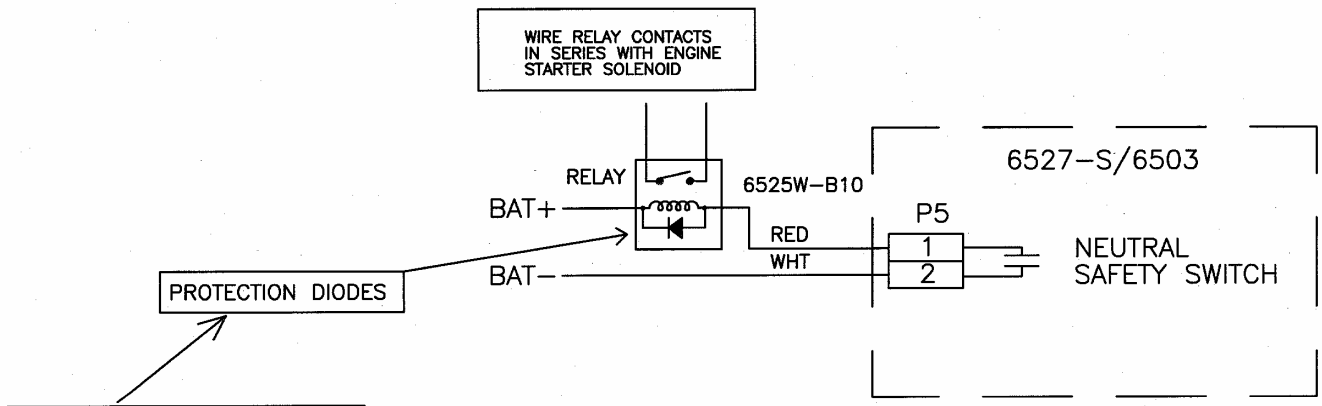
CONTRACT N/A	KOBELT MANUFACTURING COMPANY LIMITED				
CUSTOMER N/A	DWN H.A.	DY 05	MO 02	YR 04	TITLE SYNCHRO PICK UP WIRING DIAGRAM
VESSEL N/A	CHK S.C.	05	02	04	
	SCALE N/A	SHEET 1/1	DRAWING NO A-400933		REV B

Drawing 400933

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



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

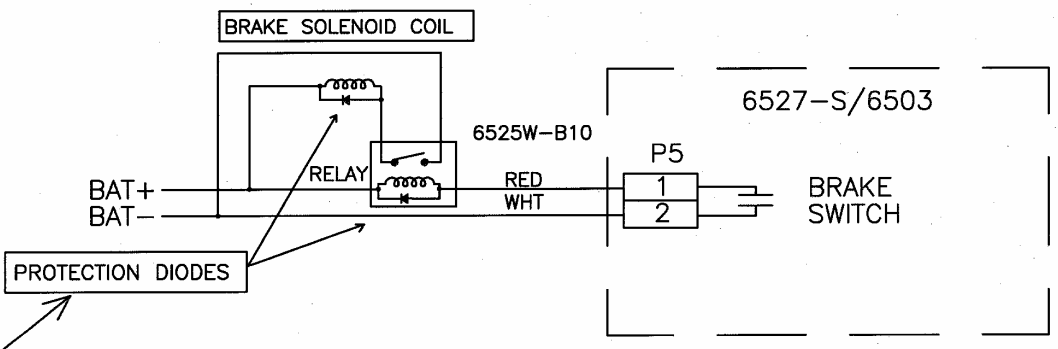
CONTRACT N/A	KOBELT MANUFACTURING COMPANY LIMITED				
CUSTOMER N/A	DWN H.A.	DY 05	MO 02	YR 04	TITLE NEUTRAL SAFETY SWITCH WIRING DIAGRAM
VESSEL N/A	CHK S.C.	05	02	04	
	SCALE N/A	SHEET 1/1	DRAWING NO A-400934		REV B

Drawing 400934

BRAKE SWITCH CABLE P/N 6525W-B10 7 COND. 18 AWG 10 MTR.		
BRAKE SWITCH	FUNCTION	WIRE COLOUR
P5-1 P5-2	BRAKE SWITCH	RED 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	KOBELT MANUFACTURING COMPANY LIMITED				
CUSTOMER N/A	DWN H.A.	DY 05	MO 02	YR 04	TITLE BRAKE SWITCH WIRING DIAGRAM
VESSEL N/A	CHK S.C.	05	02	04	
	SCALE N/A	SHEET 1/1	DRAWING NO A-400935		REV B

Drawing 400935

CABLE SCHEDULE – ELECTRONIC ENGINE CONTROLS

POWER CABLE

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

COMMUNICATION / POWER CABLE

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

SYNCHRO / NEUTRAL SAFETY / BRAKE CABLE

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

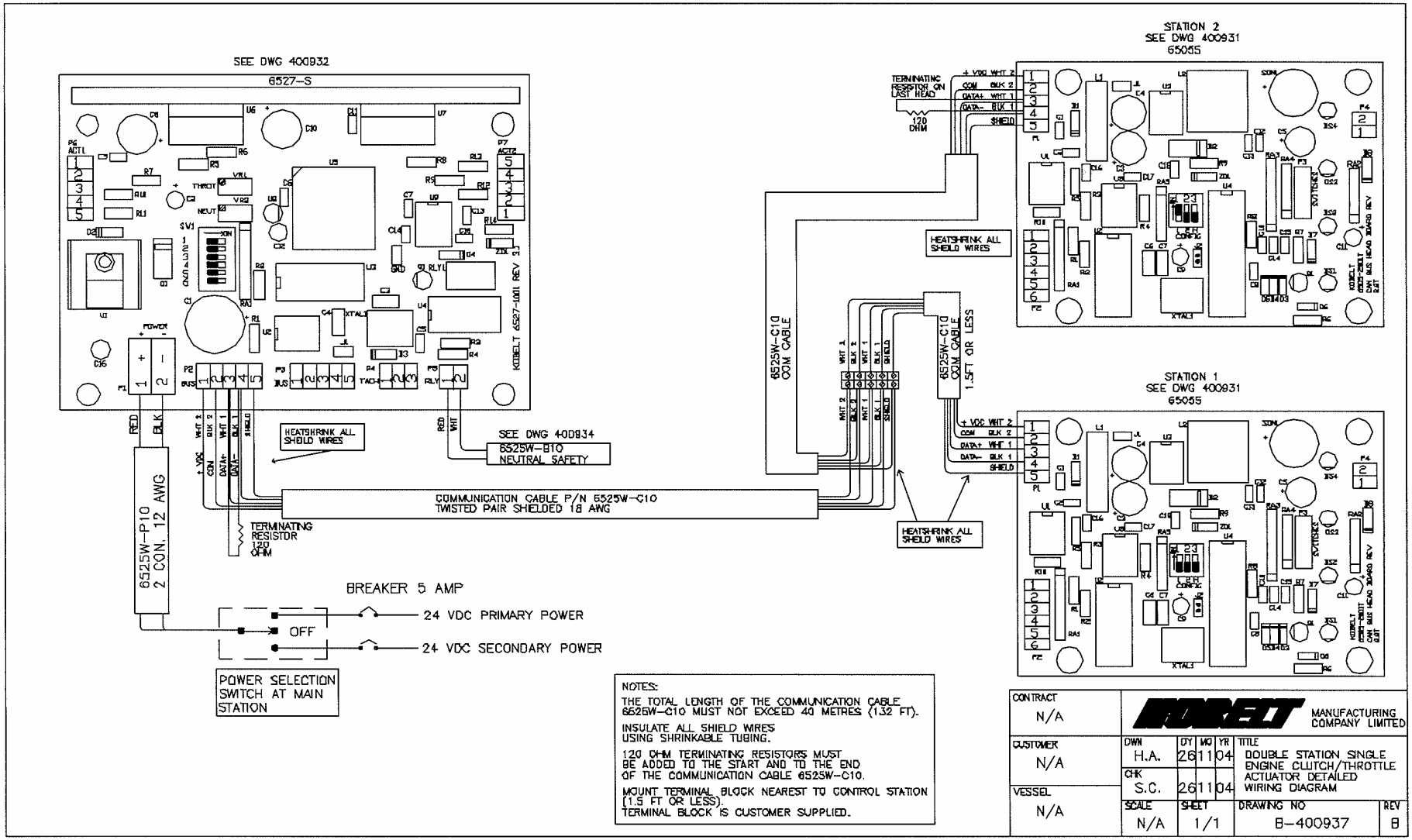
ELECTRIC CLUTCH CABLE

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

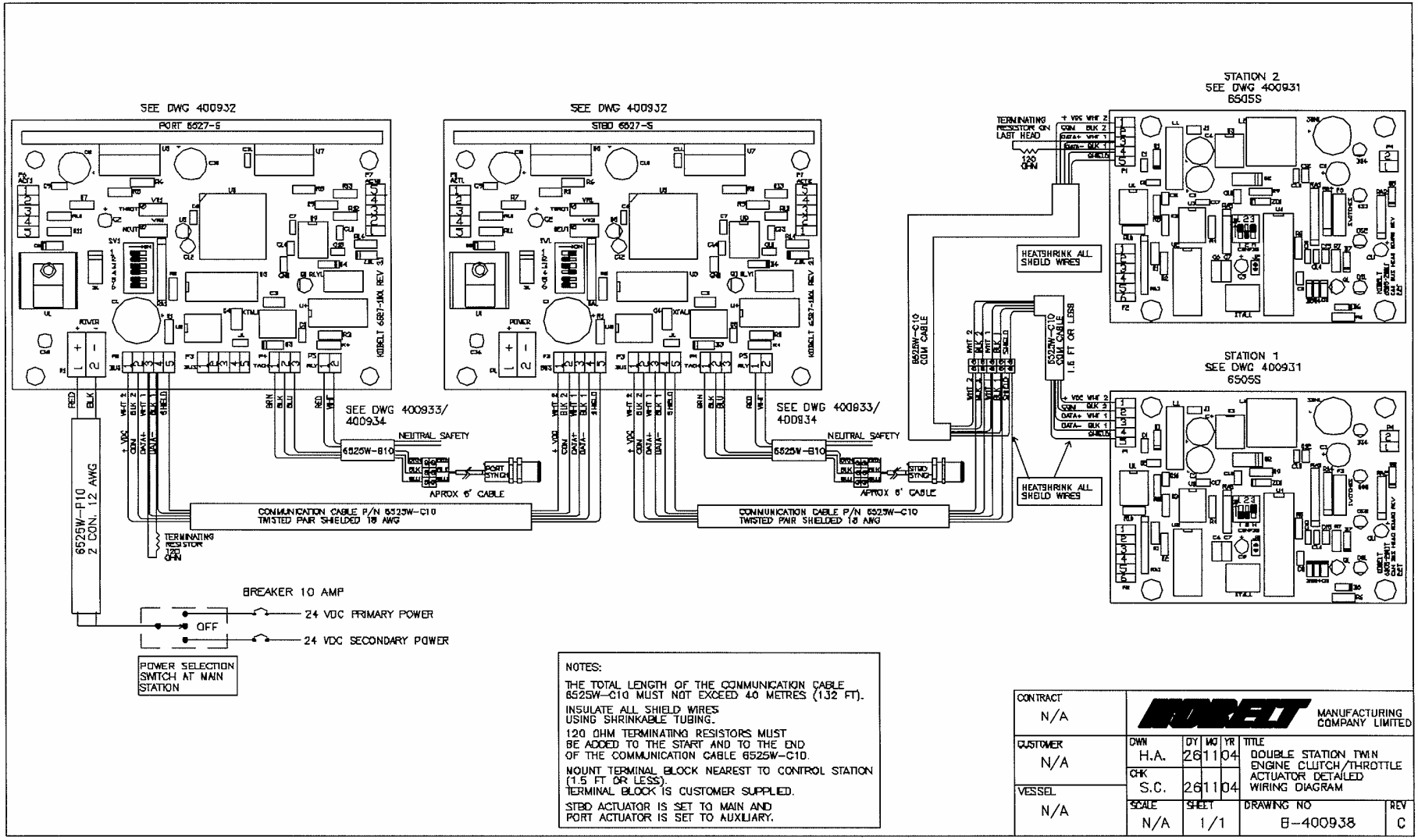
ELECTRONIC THROTTLE CABLE

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

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



Drawing 400937



NOTES:

THE TOTAL LENGTH OF THE COMMUNICATION CABLE 6525W-C10 MUST NOT EXCEED 40 METRES (132 FT).

INSULATE ALL SHIELD WIRES USING SHRINKABLE TUBING.

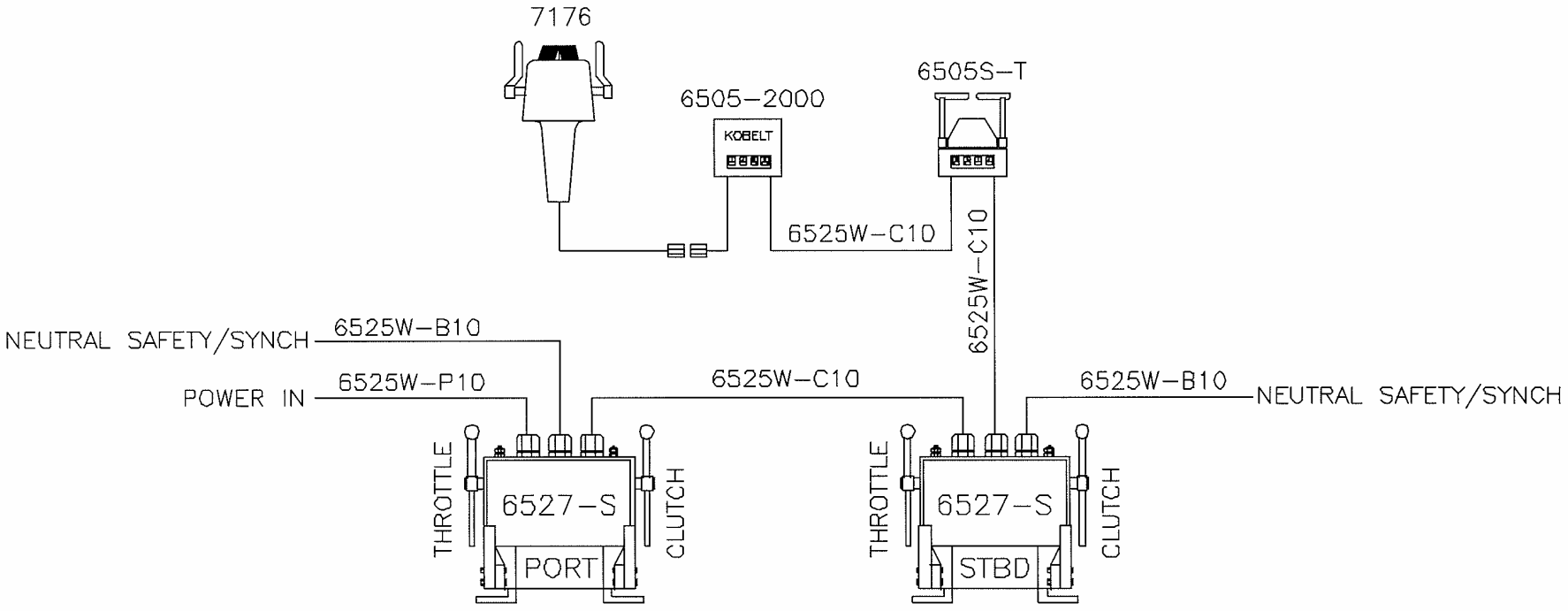
120 OHM TERMINATING RESISTORS MUST BE ADDED TO THE START AND TO THE END OF THE COMMUNICATION CABLE 6525W-C10.

MOUNT TERMINAL BLOCK NEAREST TO CONTROL STATION (1.5 FT OR LESS). TERMINAL BLOCK IS CUSTOMER SUPPLIED.

STBD ACTUATOR IS SET TO MAIN AND PORT ACTUATOR IS SET TO AUXILIARY.

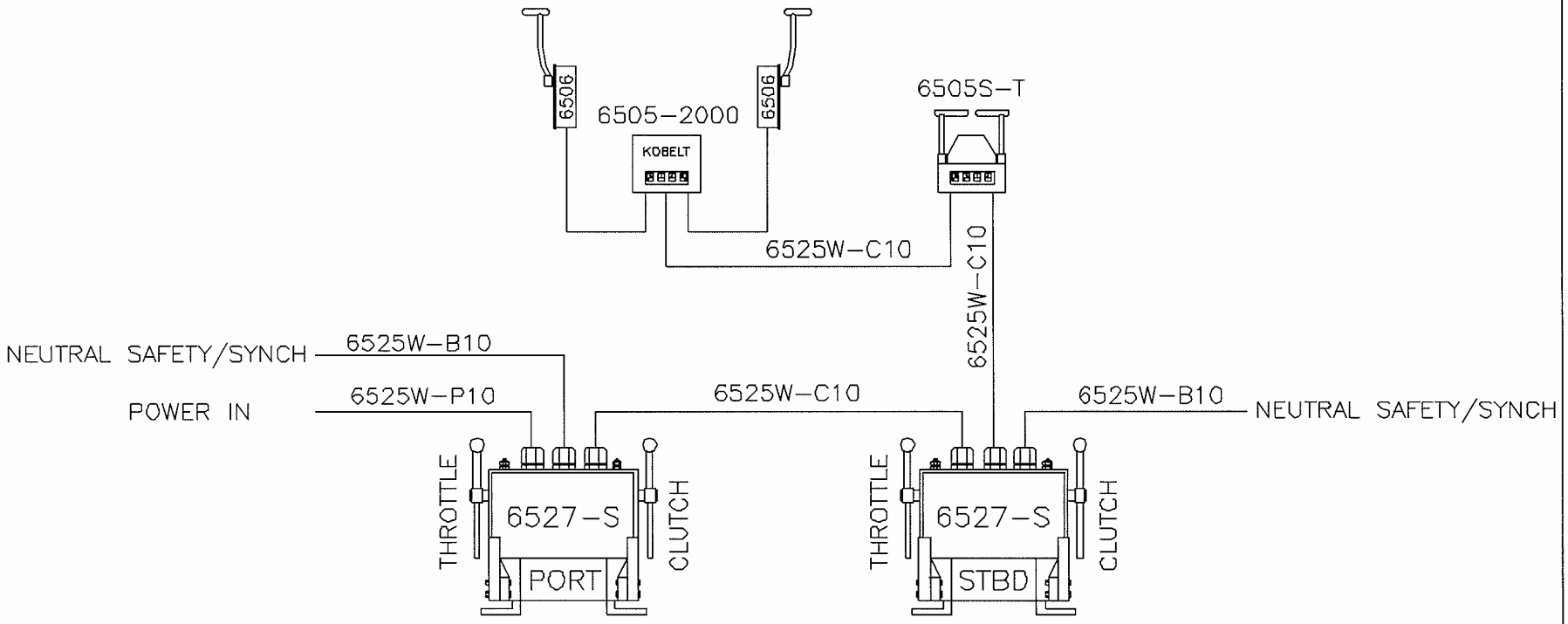
CONTRACT N/A	KOBELT MANUFACTURING COMPANY LIMITED				
CUSTOMER N/A	DWN H.A.	DY 26	MO 11	YR 04	TITLE DOUBLE STATION TWIN ENGINE CLUTCH/THROTTLE ACTUATOR DETAILED WIRING DIAGRAM
VESSEL N/A	CHK S.C.	26	11	04	
	SCALE N/A	SHEET 1/1			DRAWING NO B-400938 REV C

Drawing 400938



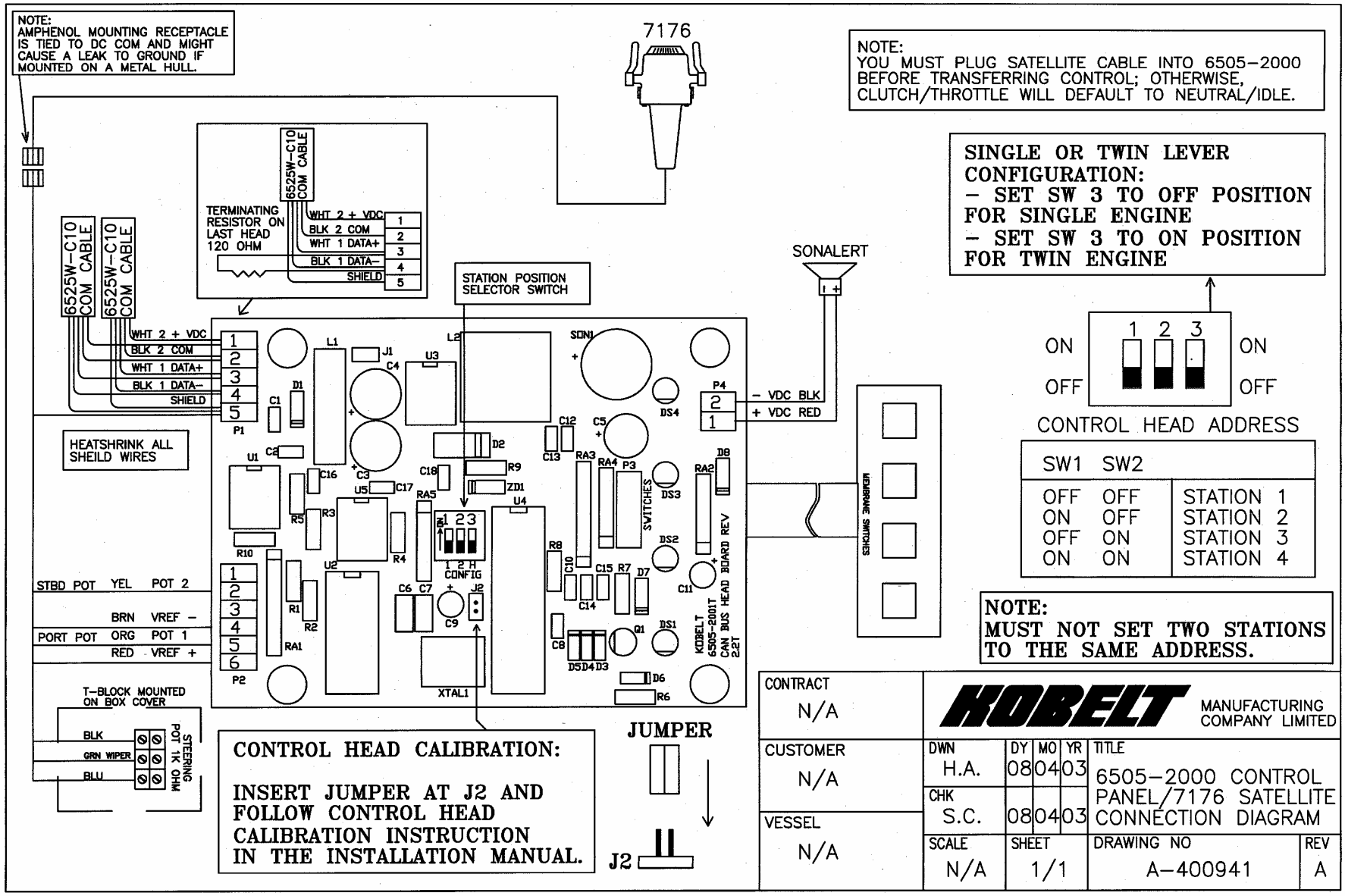
CONTRACT N/A	KOBELT MANUFACTURING COMPANY LIMITED					
CUSTOMER N/A	DWN H.A.	DY 26	MO 11	YR 04	TITLE DOUBLE STATION TWIN ENGINE CLUTCH/ THROTTLE ACTUATOR	
VESSEL N/A	CHK S.C.	26	11	04		
	SCALE N/A	SHEET 1/1			DRAWING NO A–400939	REV B

Drawing 400939

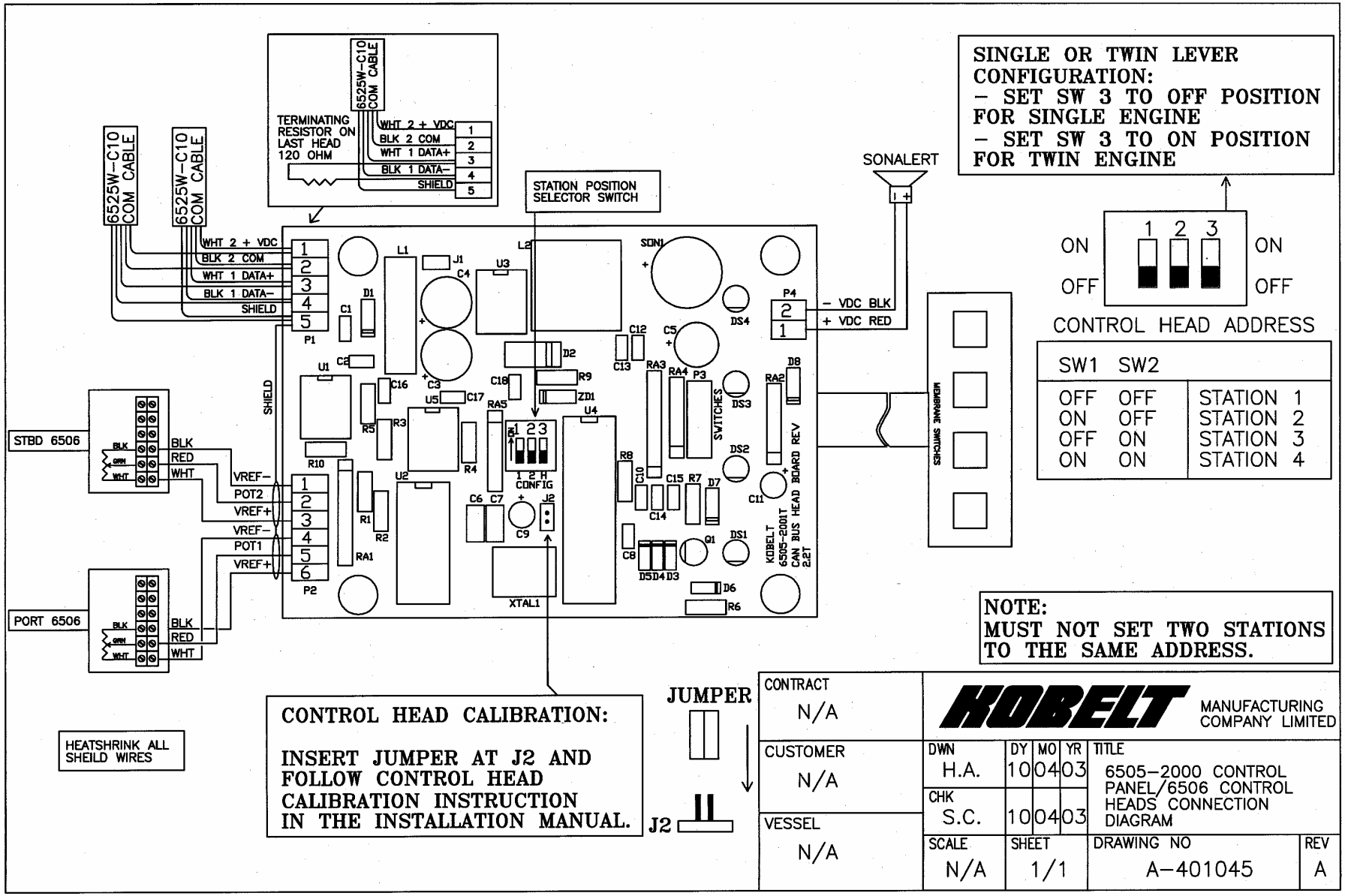


CONTRACT N/A	KOBELT MANUFACTURING COMPANY LIMITED					
CUSTOMER N/A	DWN H.A.	DY 26	MO 11	YR 04	TITLE DOUBLE STATION TWIN ENGINE CLUTCH/ THROTTLE ACTUATOR	
	CHK S.C.	26	11	04		
VESSEL N/A	SCALE N/A	SHEET 1/1			DRAWING NO A-400940	REV B

Drawing 400940



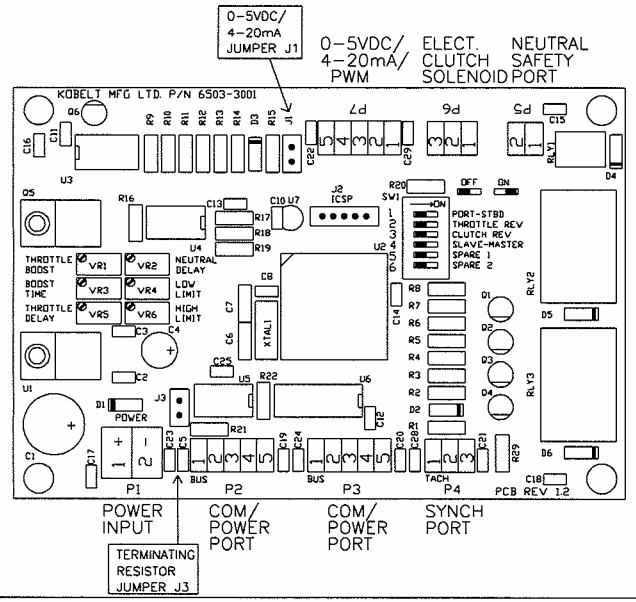
Drawing 400941



Drawing 401045

SW 1 FUNCTION				
OFF ⟶ ON	OFF POSITION	ON POSITION	ELECTRONIC CARD	FUNCTION
1	PORT UNIT	STBD UNIT	N/A	PORT/STBD UNIT
2	NORMAL	REVERSE	THROTTLE SIGNAL	TRAVEL DIRECTION
3	NORMAL	REVERSE	CLUTCH SIGNAL	TRAVEL DIRECTION
4	AUXILIARY	MAIN	N/A	SYNCHRONIZER
5	NOT USED	NOT USED	NOT USED	NOT USED
6	NOT USED	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	RATE
VR 5	THROTTLE DELAY SEE NOTE 1	0-24 SECONDS	CW	CCW	1.25 TURN/SEC
VR 2	NEUTRAL DELAY SEE NOTE 1	0-24 SECONDS	CW	CCW	1.25 TURN/SEC
VR 1	THROTTLE BOOST	0%-25% THROTTLE	CW	CCW	1.25 TURN/1% THROTTLE
VR 3	THROTTLE BOOST TIME	0-5 SECONDS	CW	CCW	6 TURN/SEC

ELECTRONIC THROTTLE OUTPUT ADJUSTMENT					
POT	FUNCTION	% THROTTLE SIGNAL	INCREASE	DECREASE	RATE
VR 4	LOW LIMIT AJDUST	0% - 40% THROTTLE SIGNAL	CW	CCW	0.75 TURN/1% THROTTLE
VR 6	HIGH LIMIT ADJUST	60% - 100% THROTTLE SIGNAL	CW	CCW	0.75 TURN/1% THROTTLE

NOTE 1: MUST SET THROTTLE DELAY FOR 1 SECOND MINIMUM AND NEUTRAL DELAY FOR 1 SECOND MINIMUM.
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).

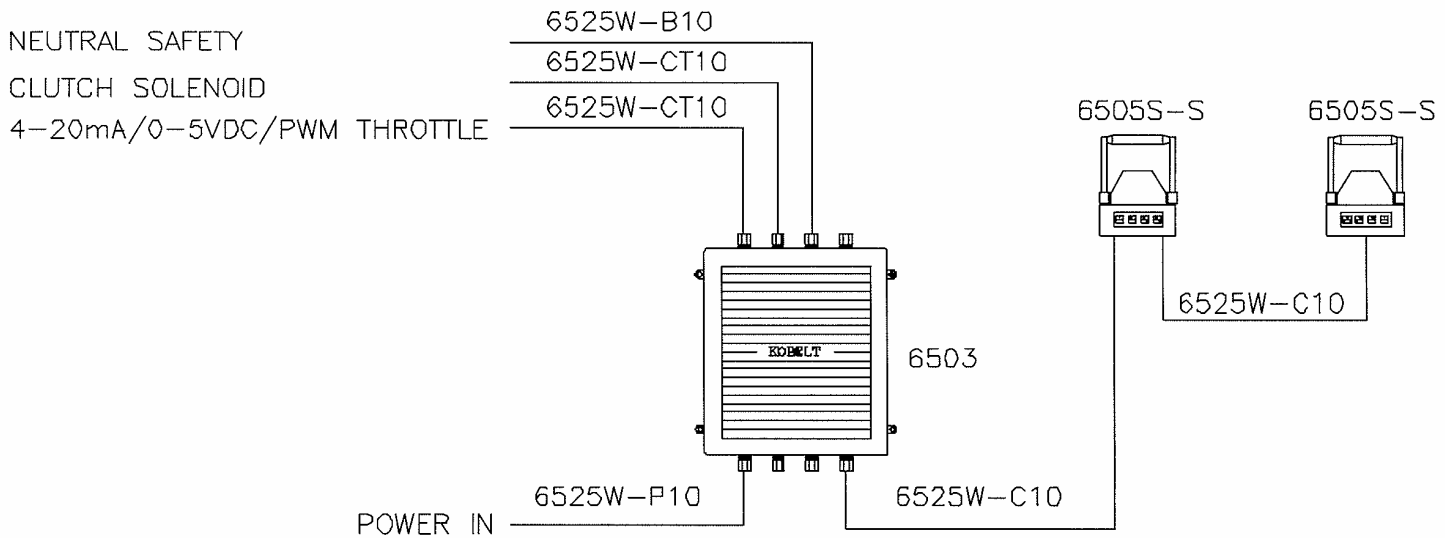
NOTE FOR SINGLE ENGINE CONFIGURATION:
SW 1 MUST BE SET TO OFF POSITION (PORT UNIT).

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.

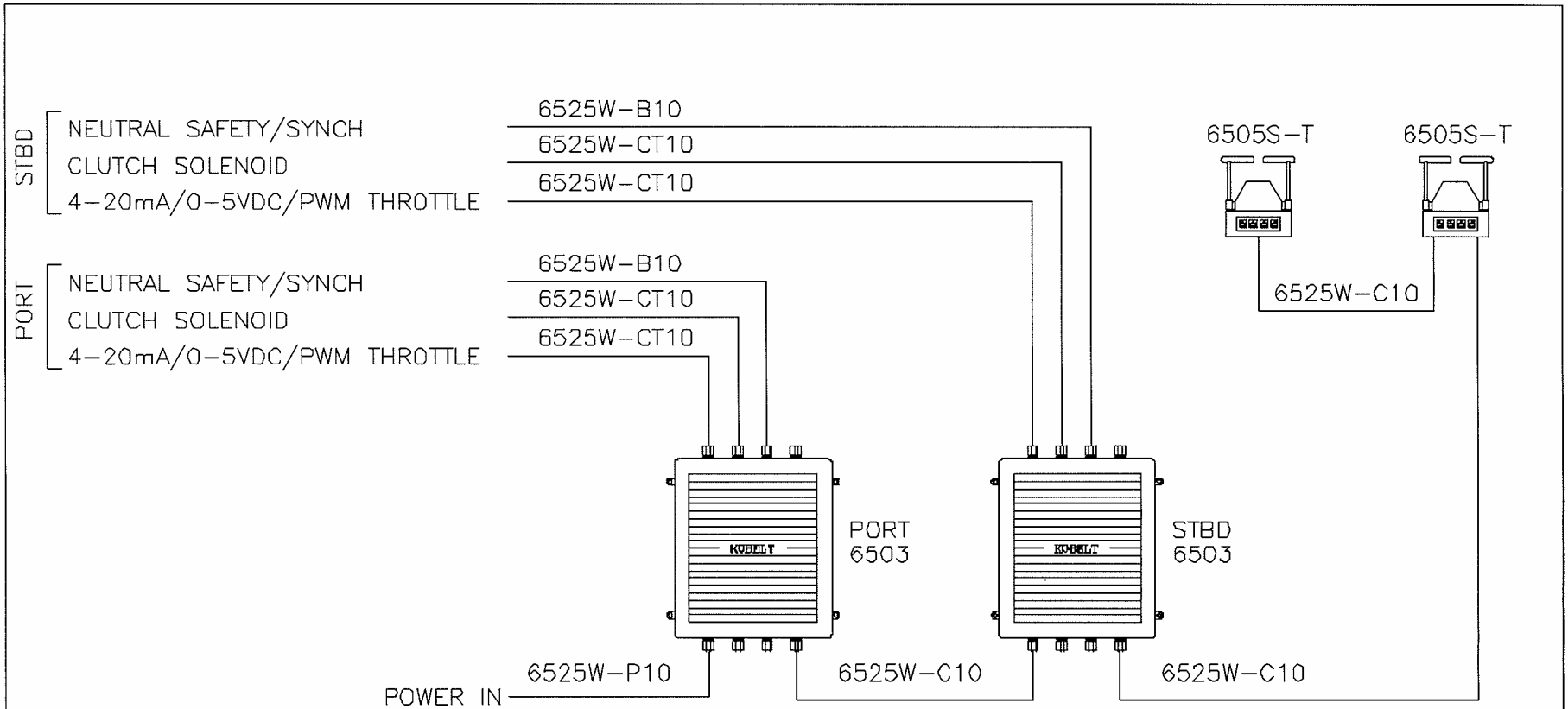
CONTRACT N/A	KOBELT MANUFACTURING COMPANY LIMITED				
CUSTOMER N/A	DWN H.A.	DY 20	MO 04	YR 12	TITLE 6503-3001 ELECTRONIC INTERFACE CARD SYSTEM ADJUSTMENT
VESSEL N/A	CHK S.C.	20	04	12	
	SCALE N/A	SHEET 1/1	DRAWING NO B-401126		REV B

Drawing 401126



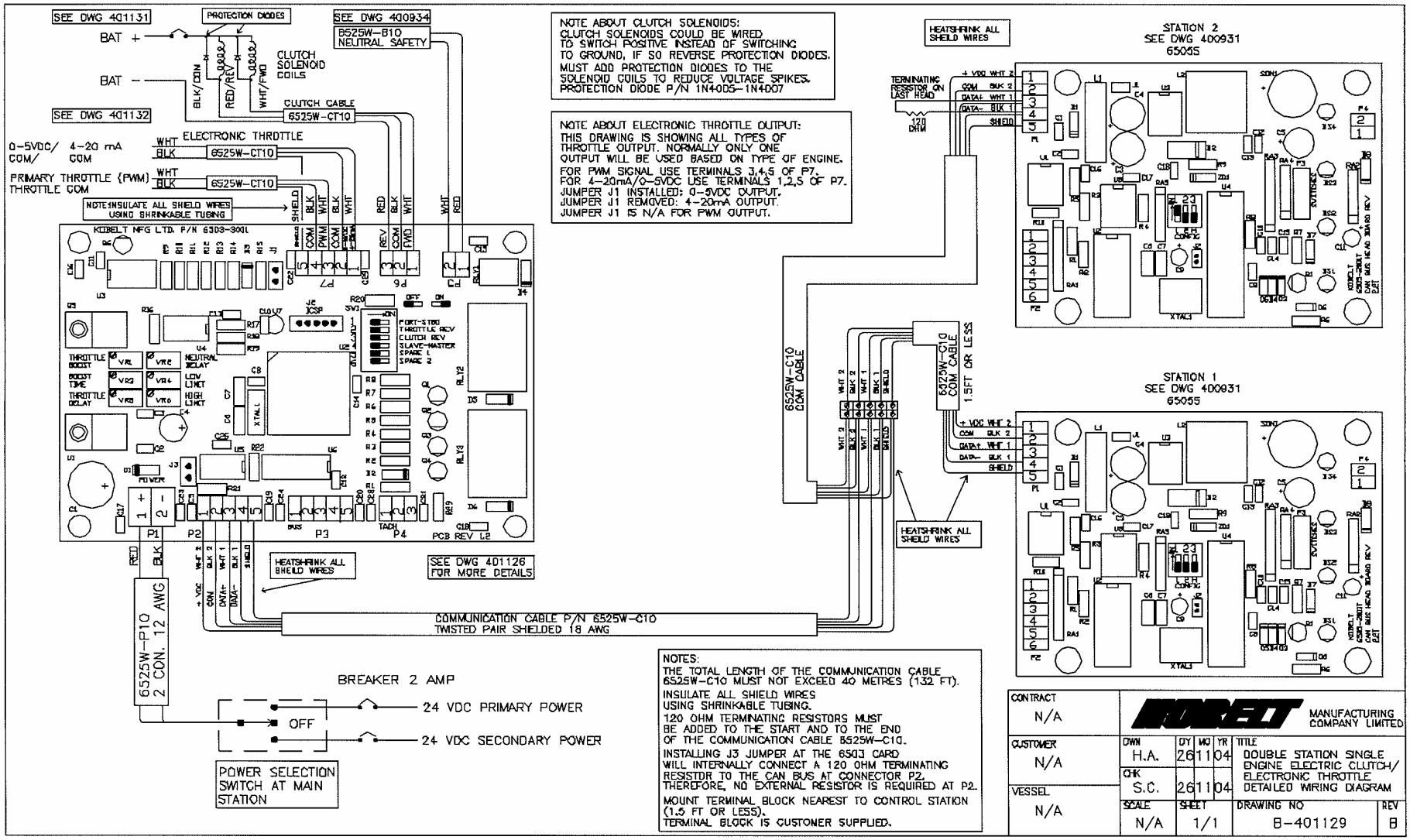
CONTRACT N/A	KOBELT MANUFACTURING COMPANY LIMITED					
CUSTOMER N/A	DWN H.A.	DY 26	MO 11	YR 04	TITLE DOUBLE STATION SINGLE ENGINE ELECTRIC CLUTCH/ ELECTRONIC THROTTLE	
VESSEL N/A	CHK S.C.	26	11	04		
	SCALE N/A	SHEET 1/1			DRAWING NO A-401127	REV B

Drawing 401127

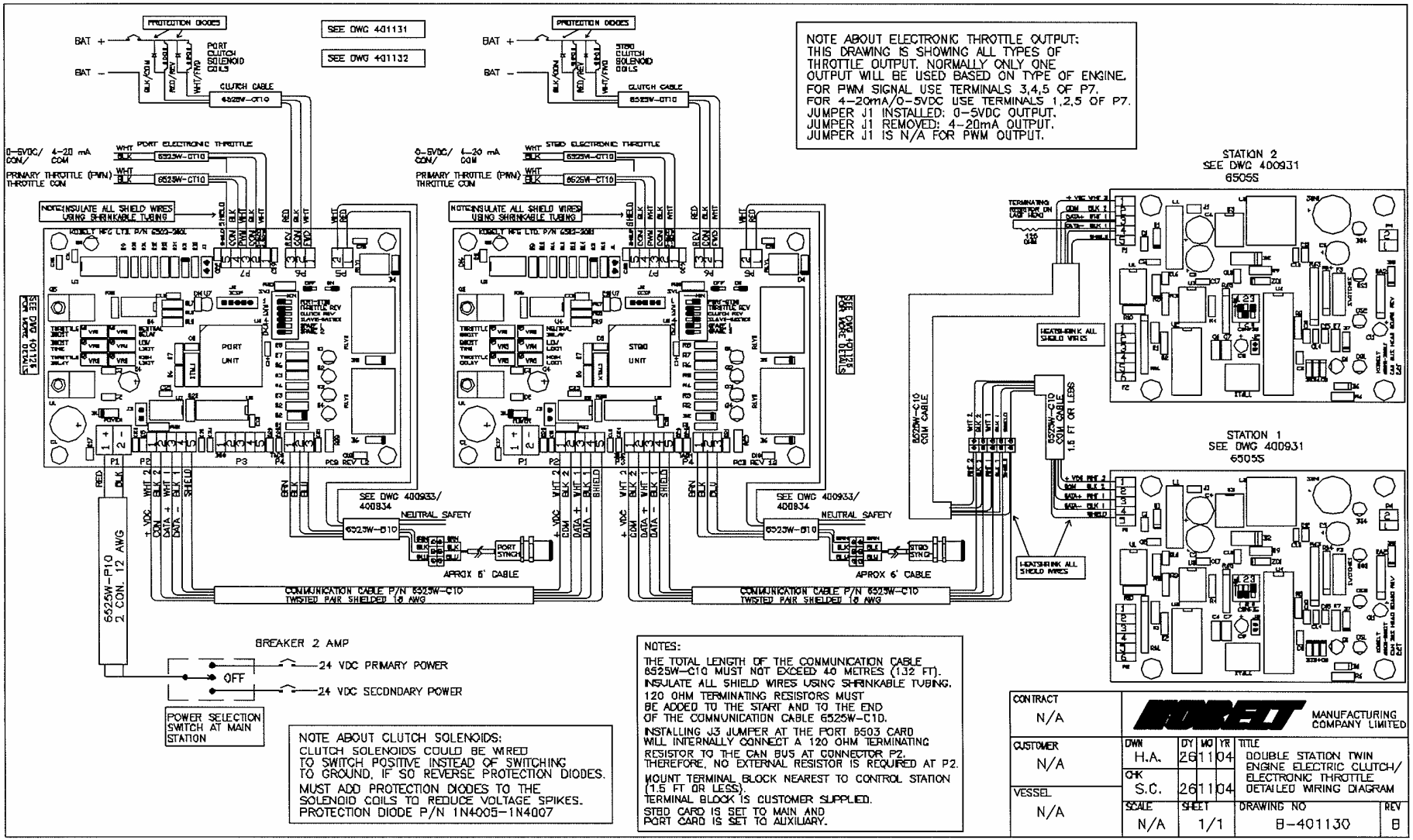


CONTRACT N/A	KOBELT MANUFACTURING COMPANY LIMITED					
CUSTOMER N/A	DWN H.A.	DY 26	MO 11	YR 04	TITLE DOUBLE STATION TWIN ENGINE ELECTRIC CLUTCH/ ELECTRONIC THROTTLE	
	CHK S.C.	26	11	04		
VESSEL N/A	SCALE N/A	SHEET 1/1			DRAWING NO A-401128	REV B

Drawing 401128



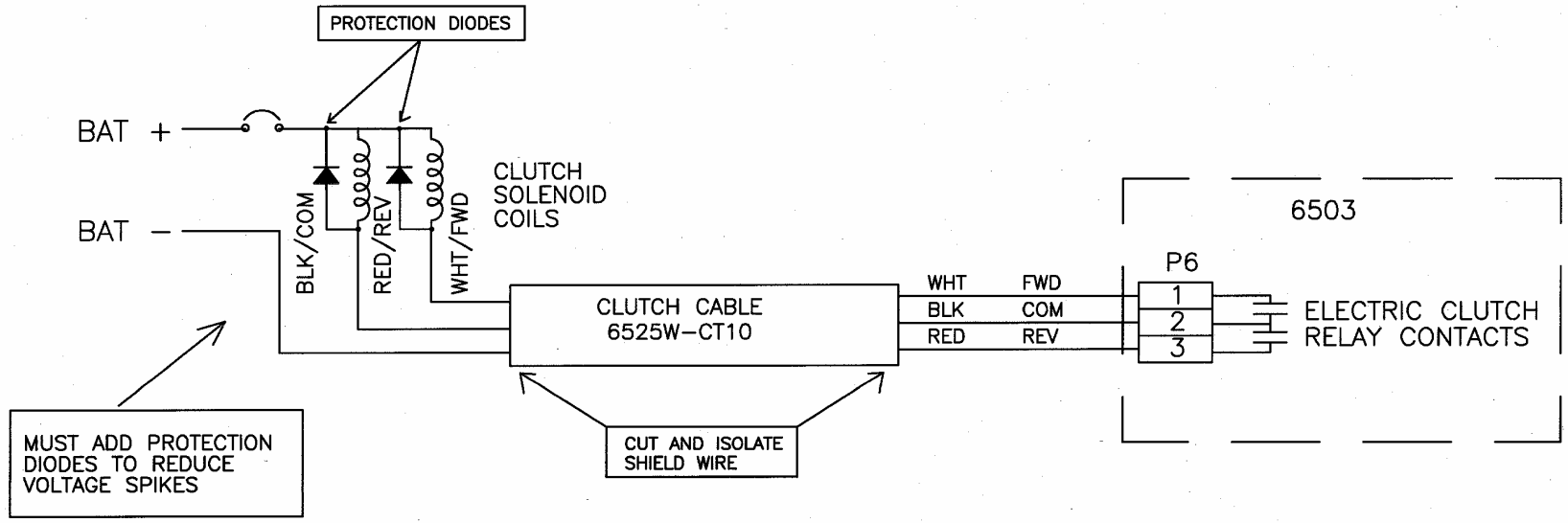
Drawing 401129



Drawing 401130

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

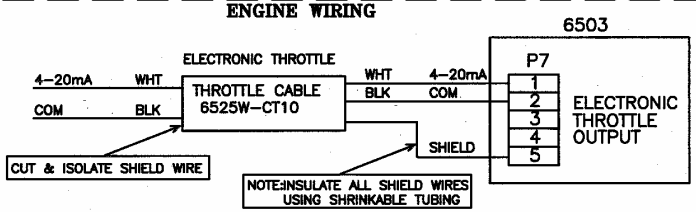


CONTRACT N/A	KOBELT MANUFACTURING COMPANY LIMITED					
CUSTOMER N/A	DWN H.A.	DY 27	MO 11	YR 03	TITLE 6503 ELECTRIC CLUTCH OUTPUT PORT DETAILED WIRING DIAGRAM	
VESSEL N/A	CHK S.C.	27	11	03		
	SCALE N/A	SHEET 1/1			DRAWING NO A-401131	REV A

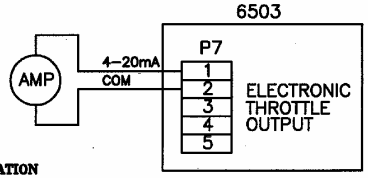
Drawing 401131

4-20mA THROTTLE OUTPUT

ENGINE WIRING



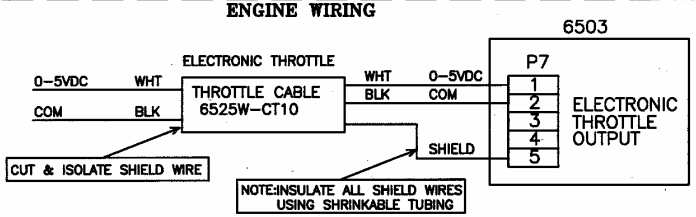
SIGNAL CALIBRATION



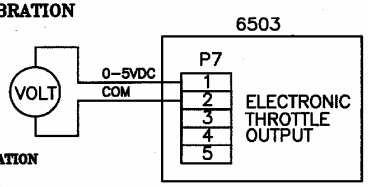
- ENGINE MUST NOT BE RUNNING DURING SIGNAL CALIBRATION
- J1 JUMPER MUST BE REMOVED FOR 4-20mA SIGNAL
- USE AN AMP METER AS SHOWN TO MEASURE THE SIGNAL
- SET THE CONTROL LEVER TO IDLE AND ADJUST VR4 (LOW LIMIT) TRIMPOT UNTIL 4mA IS OBTAINED
- SET THE CONTROL LEVER TO FULL SPEED AND ADJUST VR6 (HIGH LIMIT) TRIMPOT UNTIL 20mA IS OBTAINED.

0-5VDC THROTTLE OUTPUT

ENGINE WIRING



SIGNAL CALIBRATION

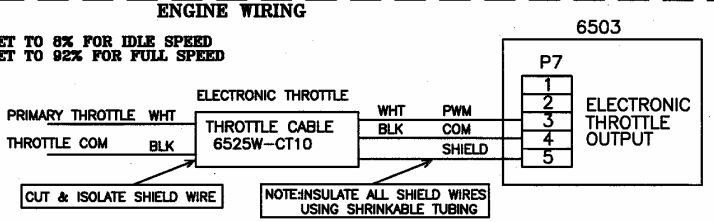


- ENGINE MUST NOT BE RUNNING DURING SIGNAL CALIBRATION
- J1 JUMPER MUST BE INSTALLED FOR 0-5VDC SIGNAL
- USE A VOLT METER AS SHOWN TO MEASURE THE SIGNAL
- SET THE CONTROL LEVER TO IDLE AND ADJUST VR4 (LOW LIMIT) TRIMPOT UNTIL DESIRED IDLE SIGNAL IS OBTAINED
- SET THE CONTROL LEVER TO FULL SPEED AND ADJUST VR6 (HIGH LIMIT) TRIMPOT UNTIL DESIRED FULL SPEED SIGNAL IS OBTAINED.

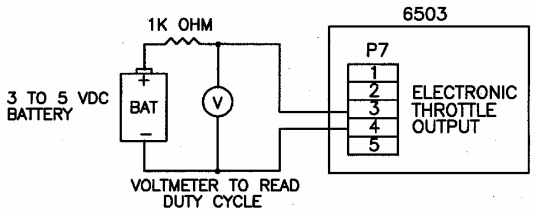
PWM THROTTLE OUTPUT

ENGINE WIRING

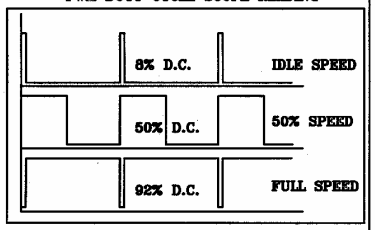
NOTE:
DUTY CYCLE IS PRESET TO 8% FOR IDLE SPEED
DUTY CYCLE IS PRESET TO 92% FOR FULL SPEED



SIGNAL CALIBRATION



PWM DUTY CYCLE SCOPE READING



- ENGINE MUST NOT BE RUNNING DURING SIGNAL CALIBRATION
- WITH THE CABLE CONNECTED TO THE ENGINE, MEASURE THE DUTY CYCLE AT TERMINALS 3 & 4 OF P7
- WITH THE CABLE DISCONNECTED FROM THE ENGINE YOU MUST USE A BAT. AND A 1K OHM RESISTOR AS SHOWN ABOVE TO MEASURE THE DUTY CYCLE. THE 6503 HAS AN OPTO-ISOLATED OPEN COLLECTOR OUTPUT
- USE A VOLT METER THAT CAN READ DUTY CYCLE AS SHOWN TO MEASURE THE PWM SIGNAL
- SET THE CONTROL LEVER TO IDLE AND ADJUST VR4 (LOW LIMIT) TRIMPOT UNTIL 8% DUTY CYCLE IS OBTAINED
- SET THE CONTROL LEVER TO FULL SPEED AND ADJUST VR6 (HIGH LIMIT) TRIMPOT UNTIL 92% DUTY CYCLE IS OBTAINED.

CABLE INFORMATION & NOTES

ELECTRONIC THROTTLE CABLE P/N 6525W-CT10 3 COND. 18 AWG 10 MTR. SHIELD		
6503 ELECTRONIC SIGNAL	FUNCTION	WIRE COLOUR
P7-1	0-5VDC/4-20mA	WHT
P7-2	COM	BLK
P7-3	PRIMARY THROTTLE (PWM)	WHT
P7-4	THROTTLE COM	BLK
P7-5	SHIELD	SHIELD

NOTES:

- SEE DRAWING 401126 FOR MORE 6503 CARD DETAILS
- ENGINE MUST BE OFF DURING SYSTEM CALIBRATION
- THE 6503 IS ALREADY PRESET TO PRODUCE PWM SIGNAL
- SIGNAL CALIBRATION IS REQUIRED IF 4-20mA OR 0-5VDC SIGNAL IS DESIRED.

CONTRACT: N/A	KOBELT MANUFACTURING COMPANY LIMITED			
CUSTOMER: N/A	DWN: H.A.	DY: 28	MO: 11	YR: 03
	CHK: S.C.	28	11	03
VESSEL: N/A	SCALE: N/A	SHEET: 1/1	DRAWING NO: B-401132	REV: A

TITLE: PWM, 0-5VDC, 4-20mA ELECTRONIC THROTTLE SET UP PROCEDURE

Drawing 401132