



E-Series Commander **Electronic Steering**



**For Catamarans
Power Cruisers
Motor Yachts
10 metres - 30 metres**



E-Series Commander Steering Systems

INSTALLATION MANUAL

The following pages of the manual give a complete overview of the system and include wiring diagrams as well as schematics for various steering configurations.

Prior to actual installing the system, take time to carefully read this information, so you are aware of cabling and mechanical requirements etc. Also take particular note of the following information.

IMPORTANT NOTES

- Your electronic steering system has been fully tested with all the components supplied
- All items such as electronic wheels, follow-up levers and rudder transducers have been fully tuned in advance and require NO adjustments to be made.
- **Do NOT remove the tiller arm** from the rudder transducer for any reason. The position of the arm has been preset and the electronic adjustments have been made for you.
- Do not attempt to trim or change limit positions in the junction box. Instructions provided in the manual are supplied only for future use in the event that you need additional stations or for replacement items.
- Cables have been supplied for connection from controllers and rudder transducers only. Cables for power and for connection to the solenoid valves are customer supply and should be of suitable type.

CRITICAL SYSTEM NOTES

The cable from the rudder transducer to the junction box is a fully shielded multicore cable and is critical to the function of the steering system as a whole.

- **UNDER NO CIRCUMSTANCES** should this shielded data-cable come closer than 300mm to any AC power cable or high current DC cable. It must be kept at least 300mm apart and if it is necessary to cross over an AC cable of any kind it must do so at 90 degrees – it must never run parallel. Failure to do this can result in induction of voltage (coupling) and give false heading information which will result in erratic and potentially dangerous steering. This is standard international wiring practice for all data cables on vessels, industrial installations and building regulations.
- Do **NOT** cut this cable – the shields must be intact and connected to prevent RF interference.
- The same rules apply to the shielded data-cables connecting each of the helm units and control panels to the junction box.

HYDRIVE ENGINEERING PTY LTD

ABN 14 007 660 808

E-Series Commander STEERING SYSTEM GENERAL INTRODUCTION SYSTEM DESCRIPTION

Depending on your particular system you may or may not be supplied with all the items described below. You should refer to your circuit drawings to identify the appropriate items.. Do not attempt to install the system without first reading all the information contained in this section and the following section ES-805 manual 01.013

Components are supplied in modular form for ease of installation, as follows:-

HYDRAULIC POWER PACK. This may be an existing power pack – or one that has been supplied as part of your system. It must have 12/24VDC Solenoid valves for directional control with fully adjustable flow controls which are pressure-compensated.

ELECTRONIC HELM UNIT

The HyDrive ES-801 helm unit is installed through a hole in the console and connected via cable and then plugged directly into the socket on the rear of the HyDrive ES-801C Selector panel. The Panel should always be located adjacent to the wheel for safety reasons. Selection of the wheel is done by pressing STEER on the panel.



OPTIONAL ELECTRONIC FOLLOW-UP LEVER

The HyDrive ES-803 follow-up lever can be used as an alternative to the standard helm unit and acts in the same way as the steering wheel – following up to the required rudder angle. This can be used in addition to the standard helm, giving additional steering control stations for areas such as bridge wings, aft stations and fly-bridge positions etc.



SELECTOR PANEL

The ES-801C selector panel is used for selection of all steering stations and works in conjunction with the steering device. Simply press STEER and the attached control unit, helm, lever, takes control. The selection of any other station STEER command takes control at that position



ES-801C SELECTOR PANEL

ES-803 FOLLOW-UP LEVER

RUDDER TRANSDUCER

The rudder transducer is to be installed adjacent to the tiller arm. And the centre line of the transducer must be exactly central to the rudder stock and the drag link supplied is to be connected at 90 degrees to the tiller arm in mid-stroke position and at 90 deg to the transducer arm, making a parallelogram. See drawing provided. NOTE: the transducer has been fully pre-set to ZERO prior to shipment/ DO NOT REMOVE THE TRANSDUCER ARM at any time – Leave it exactly as it is delivered. This will avoid time-consuming re-calibration of the system.



ES-805 Commander Junction Box

The ES-805 is the heart of the steering system and all devices are connected to it. There is in-built provision for the following:-

- Up to three follow-up steering positions using any of the E-series control units
- Single rudder or twin rudder with tie-bar using single rudder transducer
- Twin rudders without tie-bar in electronic synchronisation using twin rudder transducers
- Two rudder indicators
- Single wheel indicator
- Autopilot connection – can be used with either clutch circuit input or solenoid input from autopilot. Connection of solenoid connections should be made directly to the junction box and not to the solenoid.
- Unlimited non-follow-up joystick controllers
- Emergency joystick over-ride.
- Limit switches for emergency joy stick



ES- 805
Junction Box

INSTALLATION

1. **ALL ELECTRICAL WORK SHOULD BE CARRIED OUT ONLY BY FULLY QUALIFIED TRADESPERSON.**
2. The ES-805 junction box should also be provided with its own 24VDC supply as indicated. This supplies power to all control systems. The control panels remain active so long as power is connected. A remote relay should be installed by the builder and activated by a separate switch on the bridge. Power directly from the ignition is not recommended for safety reasons to ensure that the steering can be switched off without interfering with engine function.
3. For safety reasons it is highly recommended that TWO separate 24Volt power supplies be made available for the steering system in case of failure of one supply.
4. Install the ES-805 in an easy access location and within the distance for the cable provided for the ES-801C selector panel
5. The ES-801C panel should be connected via the supplied cable to the junction box as per the hook-up drawing in this manual. The cable is preconnected to the 801C for ease of connection and the colour coding should be followed for connection into the green terminal plug in the junction box.
6. Connect the rudder transducer cable to the junction box as per electrical drawing provided. **DO NOT remove the tiller arm of the transducer** - the unit has been pre-set to zero position and must not be disturbed to avoid additional tuning. Ensure the geometry of the transducer is correct and to the drawings included in this manual.
7. Connect cable to the solenoids as per the drawing.
8. Connect all other additional equipment supplied for your system as per the drawing.

OPERATION

1. At the bridge panel when power is present the LED will remain lit and backlighting is on.
2. To give control of steering to the E-Series steering – press STEER button which will light the LED and select the control type for that station.
3. When the autopilot is engaged, the steer LED will go out and the pilot will take full control To re-engage the wheel press the STEER button. It is best then to turn the pilot back to standby or off.

HYDRAULIC INSTALLATION:- should be in compliance with the power steering installation manual supplied with your system and should only be carried out by fully qualified hydraulic trades personnel.

The hydraulic system should be completely installed and bled prior to engaging the electronic controls for the best results. Operation of the solenoid valves on the power pack should be effected either by independent joystick or by manually depressing the solenoid end-buttons to purge the air from the system.

SYSTEM SET-UP

Once all electrical and electronic connections have been made to the system in accordance with the hook-up drawings included in this manual and the hydraulics have been bled, then the system is ready to be turned on.

Your system has been fully tested and tuned prior to shipment so the rudder transducers, helm position and rudder indicators (if supplied) will require no adjustment.

In the event that changes are made to the transducer arm – then the information on adjustment is included in the technical section in the rear of this manual.

1. Apply power to the junction box – 12-24VDC.
2. The ES801C panel will now be active and the rudder indicators (if fitted) will operate and show position of the rudder(s). If the rudder indicators are independent with their own transducers these should have been setup and checked for correct directional movement prior to testing the steering system.
3. Turn the steering wheel hard-over and then bring back 1.5 turns so that the wheel is relatively central. Press the steer button and the LED should light up indicating the station now has control. It is important to watch the rudder indicator at this time.
4. The steering will now operate in accordance with the wheel position.
5. If the wheel angle is not the same as the rudders when powered on – then the system will slowly move the rudders to line up. With each other before returning wheel control to the right speed.
6. If the rudder is moving in the wrong direction to the wheel – or running hard-over then **turn the system off immediately**. The solenoids have been wired back to front and so you need to reverse the solenoid wiring so that they drive in the correct direction.
7. Using the joystick control only move the rudders left and check that the rudders are actually moving in the correct direction as the rudder itself. If moving in the wrong direction – then change the wiring of the joystick to the correct direction at the terminal block. Then recheck to ensure the rudders are now going in the correct direction.
8. It is important that you now make sure that the rudder indicator itself is showing the right direction . Move the rudder(s) with the joystick. If the rudder indicator is going the wrong way then we need to reverse the wiring of the rudder indicator itself to change direction. Do this in the ES-805 junction box. Switch the power off to make the changes.
9. Turn the power back on and then select STEER on the controller – the system will now give wheel control of the rudder position and the system is ready for final testing.

SYSTEM TEST

The rudder limits have been preset prior to shipment however it is important to check that installation of the rudder transducer(s) has not affected anything mechanically.

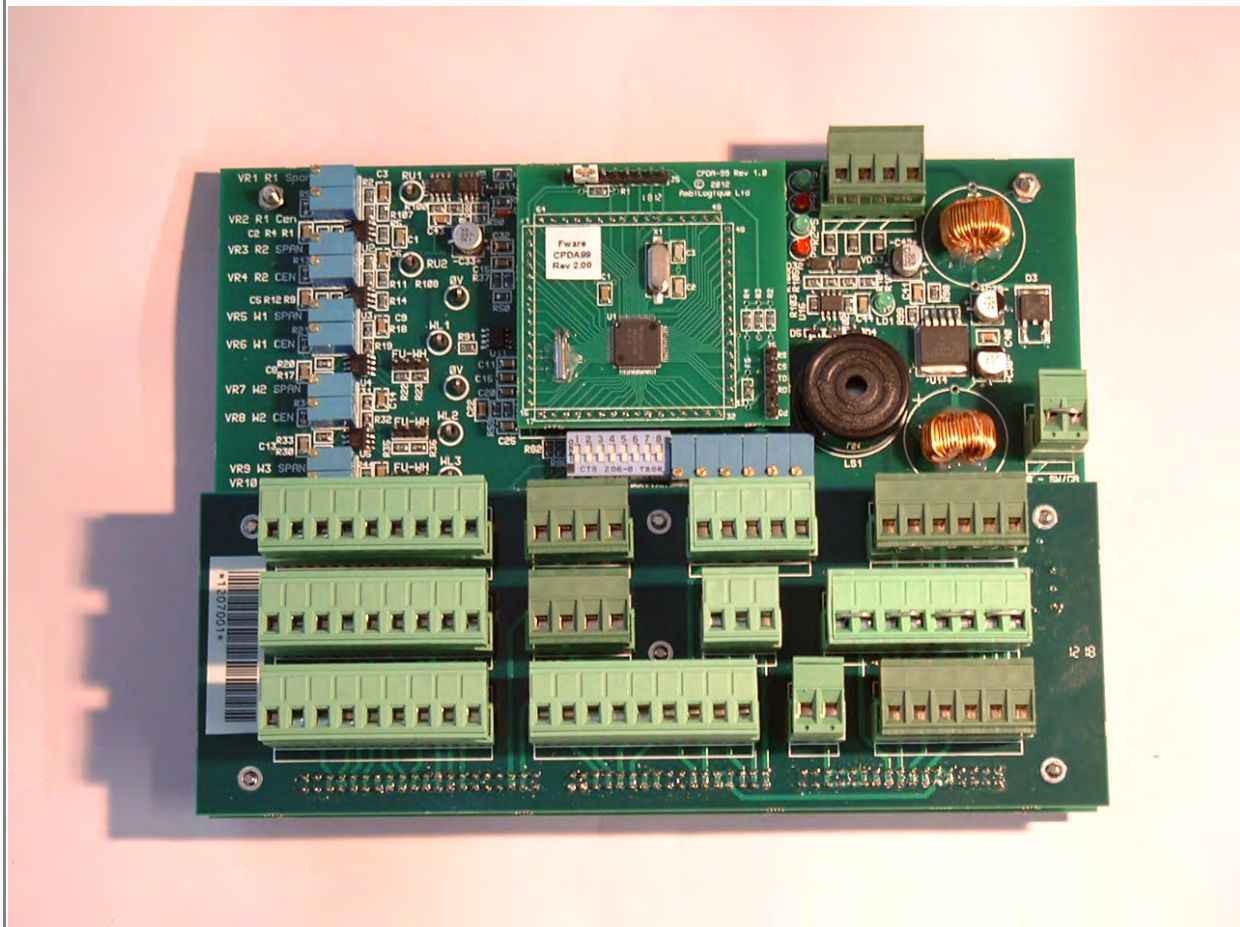
1. Turn wheel hard-over one way till end of wheel movement and check rudder indicator angle.
2. Turn wheel the other way hard-over and compare the angle. If the same within 1-2 degrees then the limits are fine.
3. If there is a significant difference in the angles – then loosen the screws holding down the rudder transducer body and rotate on the slots to centralise the movement each way – relock the screws and the system is ready for use under wheel control
4. While the wheel is selected – operate the joystick and you should see the steer LED turn off – giving control to the joystick. Re-select wheel by pressing STEER to return control.

5. If an autopilot is fitted, then this should now be selected and set up in accordance with the manufacturer's instructions. It should be connected to the ES-805 junction box as shown in the hook-up diagrams in this manual.
6. Commission the autopilot as normal and once completed – turn pilot to stand-by position.
7. Select wheel steer on the 801C control panel. The LED will come on the STEER button and you will have wheel control.
8. Select Pilot to ON position – the LED should extinguish and you will no longer have wheel control.
9. Select wheel control by pressing the STEER button while the pilot is still active and you will return control to the wheel. The pilot will still remain in the ON position but no longer have control.
10. To return to pilot control you now press the STEER button and hold for 3 seconds or more then release. The LED will go out and the pilot will resume control.

TESTS COMPLETE.

It is essential in the interests of your safety and that of the boat operators that you read the following sections thoroughly and ensure compliance with all of the relevant details for your system.

HyDrive ES-805 Commander Electronic Steering



ES-805 Junction Box

Features:-

- Controls Hydraulically Operated Rudders
- Dual Independent Rudder Servos
- Up to 3 Steering Stations with Follow-up Operation
- Independent Joystick Operation
- Control Claim and Direct Solenoid Access for Autopilot
- External Limit Switch Facility
- 11 to 32 VDC Power Input
- Angle Indicator Drives for 2 Independent Rudders and Wheel
- Connections via detachable screw terminals
- Coded Alarms
- PLC based control

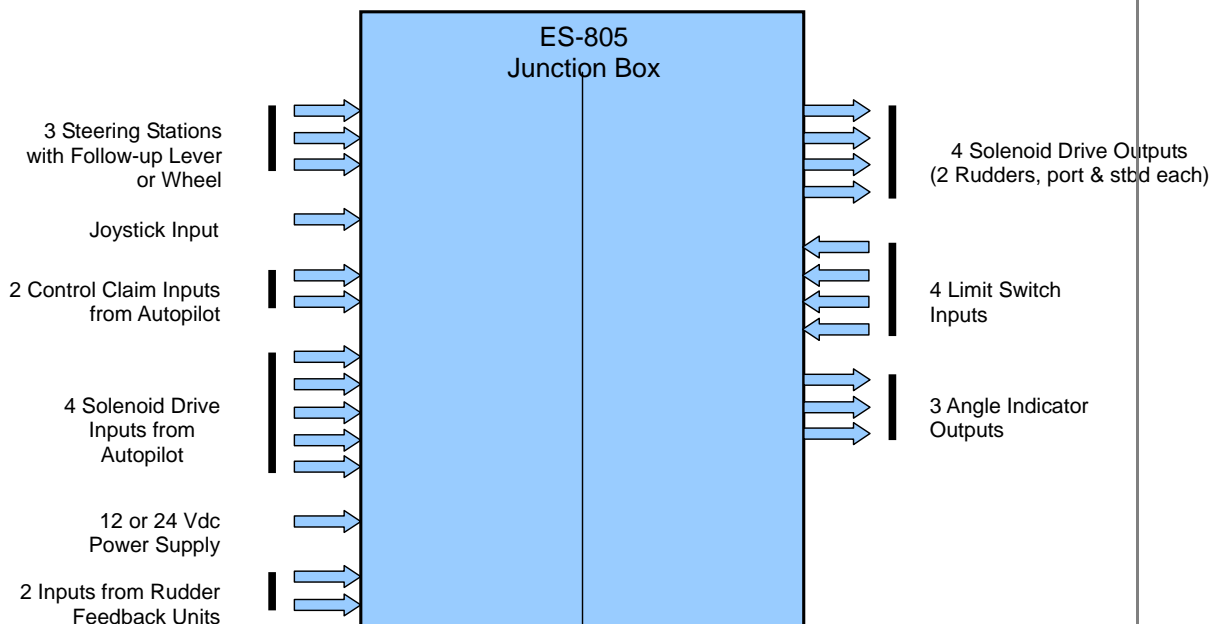
HyDrive ES-805 Commander Electronic Steering

Introduction

The HyDrive ES-805 Electronic Steering (Steer-by-Wire) system is intended for small to medium sized vessels, most typically up to 25-30 metres. It is used in conjunction with an appropriate hydraulic power pack fitted with low-voltage 12-24DC solenoid directional control valves.

The system consists of a small control box which is DC powered (12 or 24V with auto-selection) together with up to 3 steer control stations. Each steer control station consists of a small selector panel with indicator lights and an audible alarm, and a choice of conventional 3-turn wheel, single-turn mini-wheel or follow-up lever to control the steering.

The system is based on an embedded PLC (Programmable Logic Controller). This is a robust electronic controller developed for demanding and hostile applications in both the industrial control and marine steering fields. We have been applying this technology to electronic steering for superyachts and small commercial vessels for a number of years, setting the standard for robustness and reliability in electronic steering systems.



Connection Diagram

Please Note: Some parts may carry the “AmbiLogique” or “AmbiLogic” trade mark from our associate company.

HyDrive ES-805 Commander Electronic Steering

This system brings the following benefits:-

- Simple installation avoiding long hydraulic pipe runs cuts installation costs.
- Greatly improved flexibility in layout offering more options.
- Up to 3 steering stations with pushbutton selection
- Dual rudder operation with non-mechanical synchronisation cuts your installation costs on catamarans and other dual-rudder systems.
- Optional external steer facility bypasses electronics for added peace of mind.
- Autopilot interface built-in simplifies installation and cuts your costs.
- Rudder and wheel position indicator drivers built-in.
- Simple configuration and setting-up cuts commissioning costs.
- Waterproof bridge components cuts cost on exposed stations.
- Choice of wheel and follow-up lever types.
- Compact electronics box fits into small and awkward spaces.
- Low power consumption.
- Reliable, robust, well-proven industrial PLC
- This system shares the electronic hardware designs, operating systems and control diagrams used for several years on superyachts of 30 metres and more, and a wide range of commercial vessels. Your steering system is backed by experience and a solid track record in challenging conditions.

HyDrive ES-805 Commander Electronic Steering

INSTALLATION INSTRUCTIONS

The hookup diagram SBW-H02 (2 sheets) shows how the system modules are interconnected. Unused steer station connectors are simply left unwired.

Cables must be routed through the plastic glands provided on the enclosures, and the conductors and screens wired into the plug-in screw terminals provided. It is strongly recommended that wire ends be fitted with crimped ferrules before being clamped into the terminals. This provides for a much stronger, vibration-resistant installation, and greatly reduces the possibility of stray strands of wire short-circuiting.

After fitting the cables and plugging in the connectors, pull the cable through the gland so that the internal wires are slack (i.e. not under tension) then hand-tighten the gland nut. This will ensure a watertight installation.

The lid of the main junction box is fitted with a rubber gasket. Make sure that this gasket is undamaged and neatly seated in its groove before closing the lid and screwing it down. This is essential to completing a watertight installation.

1. Power.

Connect the DC power supply to J9 as shown, observing correct polarity. Reverse polarity will not do any harm, your system will just not work.

No adjustments are required for different supply voltages: the equipment will run from any DC supply from 11 to 36 V.

The supply should be fused or equipped with circuit breakers rated at 8A for 12V systems and 4A for 24V systems.

2. Rudders.

Connect the rudder position transducer to J4 as shown. If a second rudder is in use, the second transducer connects to J5.

Rudder transducers are supplied to you already calibrated, and no adjustment should be necessary. If adjustment is required, details are provided in the Technical Manual.

3. Steer Station 1.

3.1. Connect the wheel to the Steer Station Selector Panel as shown, and the Selector Panel to the Main Junction box.

3.2. The selector switch SW1 optimises the input circuit for different steer control devices. For 3-turn wheel, or mini-wheel, set the jumper to the "WH" position, that is, so that it bridges the centre pin to the pin marked "WH".

If you are using a Follow-up Lever, set the jumper to the "FU" position, that is, so that it bridges the centre pin to the pin marked "FU".

HyDrive ES-805 Commander Electronic Steering

4. Joystick and Jog-Steer Facilities.

The joystick or jog-steer buttons are connected as shown in the hookup diagram SBW-H08 sheet 1. These inputs drive the solenoids via the electronic system, so the switches in them do not need to be heavy-duty.

The Steer-by-Wire system incorporates suppression (catch) diodes, so the joystick or jog-steer facility does not need to be fitted with diodes.

5. Hydraulic Valves.

- 5.1. The valves are connected to J12 as shown. They are powered internally by the Main Junction Box.
- 5.2. The common terminal of the valves is connected to the positive of the supply, and the negative terminals of the valves are connected to the on-board PLC when one of the steer stations is selected.
- 5.3. At other times the valves are fully isolated by a relay, and can be accessed via J8. This arrangement permits an autopilot to gain control of the steering when manual steer is disengaged, or when the Steer-by-Wire system is unpowered.
- 5.4. The autopilot can be of either polarity: positive feed, negative switch or negative feed, positive switch.

6. Limit Switches

Limit switches are not normally required with this system unless a non-limited steer system is connected via the External Steer inputs on J8. If this is done, the limit switches can be connected via J10 after removing the links with which the system is shipped.

7. Rudder and Wheel Position Indicators.

This facility is designed for use with the Hy-Drive range of indicators, which are connected to J11 as shown in SBW-H08 sheet 1.

When fitted in this way, they are calibrated by means of the CEN and SPAN adjustment screws adjacent to J11 and which are labelled for Rudder Position Indicator 1, Rudder Position Indicator 2 and Wheel Position Indicator.

HyDrive ES-805 Commander Electronic Steering

8. Autopilot Connections.

8.1. The Autopilot is connected into the steering system in two ways:

- a) A Control Claim connection which senses when the autopilot is active
- b) The Steer Solenoid outputs from the autopilot.

8.2. A Control Claim input is activated when the voltage across it exceeds 6 volts.

These inputs are opto-isolated and work with either polarity, so that they can be used with clutch outputs which are switched either in the positive or negative connection - one of the Control Claim inputs is simply wired across the clutch.

This connection is shown in the hookup diagram SBW-H08 sheet 2.

8.3. If the Autopilot does not have a Clutch output, the two Control Claim inputs to the Steer-by-Wire system are connected to the Autopilot Steer outputs as shown in the second half of SBW-H08 sheet 2. Activation of either Steer output from the Autopilot will then signal a Control Claim.

8.4. The Steer outputs of the autopilot are connected to the hydraulic solenoids when the Steer-by-Wire system is inactive or switched off. Because the steer solenoids are disconnected completely from the E-Steer system when the autopilot takes control, they work with either polarity (switch-to-positive or switch-to-negative) of output from an Autopilot.

8.5. When in Servo or Dodge (Joystick) mode, the E-Steer system respects electronic limits derived from the rudder transducers. In Emergency Joystick mode, external limit switches are essential and must be connected as shown in SBW-H08 sheet 2.

Note that one set of limit switches is required for each rudder system.

8.6. This arrangement ensures that steering can be maintained from the joystick or autopilot even if there is an electronic failure in the Junction Box.

9. Deadband Control.

The deadband in the steering is used to prevent the rudder from hunting to and fro when it is aligned with the wheel.

The deadband is set by means of the Configuration Switch SW4 on the main control board. The following table gives the approximate deadband values for the various switch settings:-

| Switch No. | | Deadband, |
|------------|-----|-----------|
| 1 | 2 | degrees |
| off | off | 0.6 |
| ON | off | 0.9 |
| off | ON | 1.4 |
| ON | ON | 2 |

Note that changing the switch setting immediately alters the deadband - it is not necessary to turn off the DC power to effect the change.

HyDrive ES-805 Commander Electronic Steering

OPERATING INSTRUCTIONS

1. On Switching On.

The Status indicators on each of the Steer Station Selector Panels light up.

The boat can be steered via the autopilot or the joystick.

2. Selecting a Steering Position.

2.1. Press the Steer button on the Selector Panel. The Steer indicator will come on, and the selected wheel will take control.

2.2. When first selected, the wheel and the rudder will probably not be aligned, so the system will start to bring the rudder into line with the wheel. The deadband is set equal to the difference between the rudder and wheel positions, then progressively reduced so as to gradually tighten the steering over a period of approximately 30 seconds.

If you turn the wheel so that it moves into closer alignment with the rudder, the deadband is immediately reduced to the new difference. This means that you can manually bring the steering to its proper speed quickly, by turning the wheel to meet the rudder.

As an example, the boat has been running under autopilot for a time, and the rudder is central. You select manual steering from Station 1, and unknown to you the wheel is hard over to port.

The rudder will now start to inch to port. You notice that a turn is starting, and start to turn the wheel to starboard. You are now reducing the deadband in the steering, until your wheel position passes the rudder. The rudder is now under normal control and will follow the wheel with its customary speed.

3. Selecting Autopilot.

Switch the Autopilot to Active mode. It will engage its clutch or activate one of its Steer outputs, and this action will disengage all the manual steering positions.

None of the manual steering positions will show a Steer indicator light.

4. Overriding the Autopilot (Collision Avoidance Mode)

Press the Steer button on one of the helm control panels.

The Steer indicator comes on and you immediately gain steering control.

The autopilot is disconnected, even though it is still in Active mode.

Alternatively, if you have a joystick fitted, operating the joystick will immediately disengage both the Steer-by-Wire and Autopilot.

5. Ending Autopilot Override.

Press the Steer button on your Selector Panel for 3 seconds or more. Steering control will be returned to the autopilot.

HyDrive ES-805 Commander Electronic Steering

6. Joystick and Jog Steering Buttons.

Operating a joystick or one of the buttons on a jog-steer box will immediately de-select all of the manual steering positions.

To re-engage manual steering, you will need to press the Steer button on one of the Selector Panels.

7. Failure of the Steer-by-Wire System.

The most likely failures of the system are loss of hydraulic power or a breakdown in the rudder position encoder.

Under normal conditions, when the Steer-by-Wire system is active, the hydraulic valves are only activated for a few seconds at a time.

If the system is not operating correctly, it will be trying to correct a steering misalignment for a prolonged period, and will energise one of the valves for this lengthy time. The time allowed for the system to follow up is proportional to the amount of rudder movement demanded. This is in accordance with survey societies' (Class) rules.

If a failure of this type (called a "servo failure") is detected, the following occurs:-

- a) The audible alarms in the Main Control Unit and each of the Selector Panels are activated. A repeating pattern of "beeps" is sounded. The number of "beeps" in each burst indicates the nature of the fault.
- b) The Status indicators in the Selector Panels flash in the inverse pattern to the audible alarm, the indicator going dark during the beep and light during silent periods.

The audible alarms can be silenced by pressing the MUTE button on any Selector Panel. The indicators will continue to flash until the failure condition is removed.

This means that if normal operation is restored, the rudder will motor into line with the selected wheel, and the failure indication will be cancelled. Please note that the audible alarms still need to be cancelled manually.

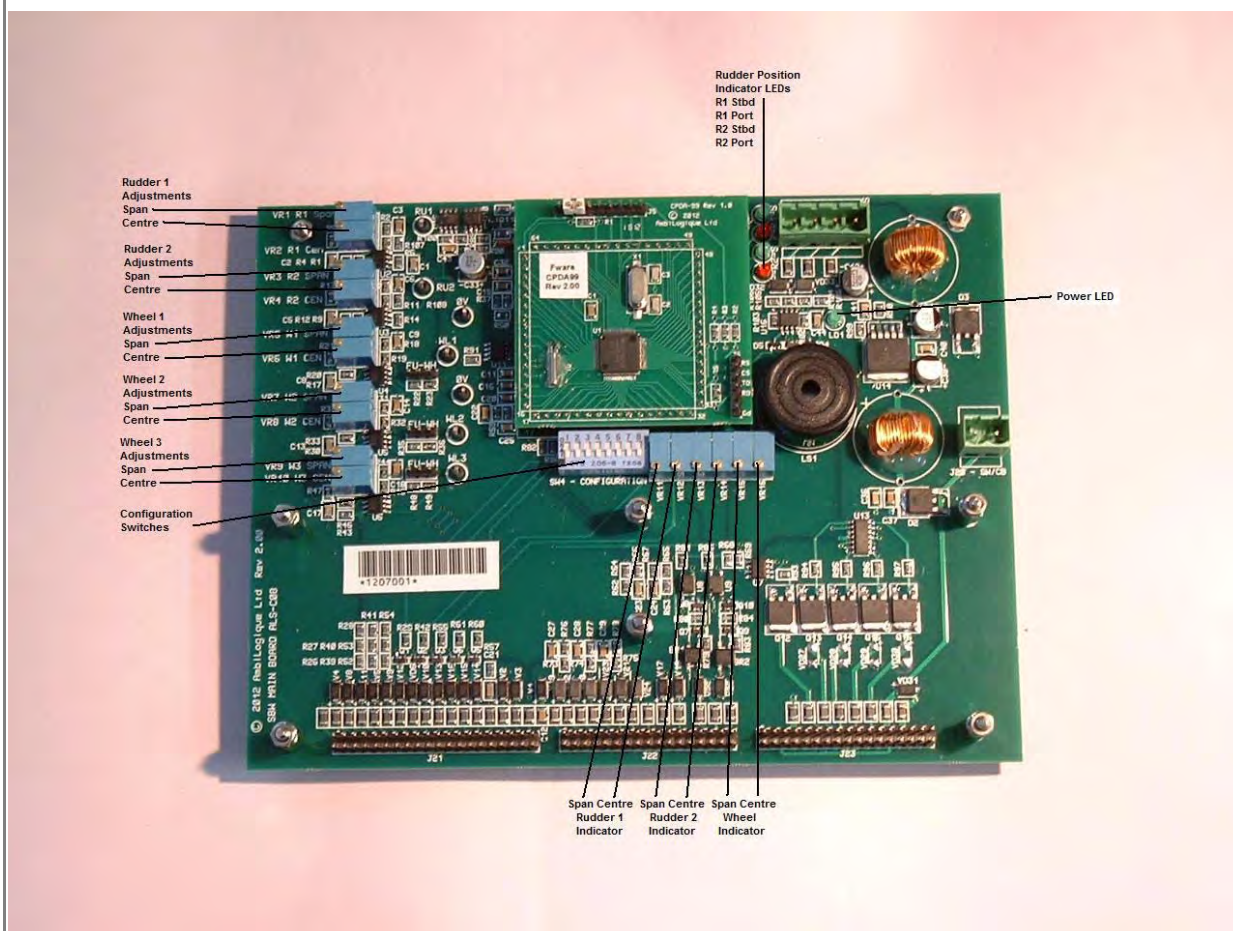
HyDrive ES-805 Commander Electronic Steering

Table 2. Fault Indication Codes

| No. of pulses | Fault |
|---------------|--|
| 5 | Wheel out of limits (open or short circuit in wheel circuit) |
| 4 | Rudder 1 out of limits (as above) |
| 3 | Rudder 1 servo failure (fail to follow up on wheel) |
| 2 | Rudder 2 out of limits |
| 1 | Rudder 2 servo failure |

HyDrive ES-805 Commander Electronic Steering

TECHNICAL MANUAL



Steer-by-Wire Controller Board (Connector Board removed for clarity)

1. On-Board Indicator LEDs

There are 5 LEDs which provide information about the status of the system:-

1.1. Power LED. This is on whenever power is applied.

1.2. Rudder Position LEDs. These are activated as follows:-

- a) If the rudder is within $\pm 1^\circ$ of the dead-ahead position, both LEDs are on.
- b) If the rudder is more than 1° port, the red Port LED is on.
- c) If the rudder is more than 1° starboard, the green Stbd LED is on.
- d) If the rudder transducer fails and the rudder feedback is out of limits:-
 - The Rudder Feedback alarm is sounded, coded as described on page 10,
 - The Status Indicators on the Steer Panels flash in inverse sympathy,
 - The appropriate Rudder Position LED flashes with the fail code.
 - An open-circuit Rudder Transducer will give a Port Fail indication: a Rudder Transducer with a ground fault will show a Stbd Fail.

HyDrive ES-805 Commander Electronic Steering

2. Configuration Switches

The Configuration Switches (SW4) are in the form of a DIP switch located between the Connector Board and the Embedded PLC (the small square board).

- 2.1. **Switches 1 and 2** control the servo deadband – see page 6 for details.
- 2.2. **Switch 3** is unassigned.
- 2.3. **Switch 4** enables the Rudder 1 servo and fault detection when on, and disables these facilities when off.
- 2.4. **Switch 5** enables the Rudder 2 servo and fault detection when on, and disables these facilities when off.
- 2.5. **Switches 6, 7 and 8** are unassigned.

3. Rudder Circuit Adjustment – *this should only be done when fitting new replacement parts or later additions as the original system has been fully pre-commissioned and is ready for use.*

- 3.1. Switch on the power and set the rudder to straight ahead (mid position on the encoder).
- 3.2. Connect a voltmeter between one of the Meter- test points (negative) and the Rudder Meter+ test point (positive).
- 3.3. The set-up voltages quoted in the following procedures are all in the 0 to 10 Vdc range. Setting accuracy should be +/- 0.1V.
- 3.4. The rudder set-up procedure will be repeated for each rudder position.
 - a) With the rudder encoder straight ahead, set the CEN control for 2.50V
 - b) With the rudder full port, set the SPAN control for 1.00V
 - c) If the rudder voltage rises when swinging to port, swap the encoder connections 2 (Stbd) and 4 (Port) on the connector J4 or J5.
 - d) With the rudder full starboard, observe the difference between the actual voltage and 4.00
 - Adjust the CEN control to remove half the difference.
 - Adjust the SPAN control to remove the rest of the difference.
 - e) Check that the voltage on full port is between 0.95 and 1.05 .
 - f) If the full port voltage is outside these limits, use the CEN control to remove half the error and the SPAN control to remove the rest. The setting can then be checked at full starboard, starting from step d). This process should rapidly converge to the point where the test point voltage at both ends of the rudder swing is correct.

HyDrive ES-805 Commander Electronic Steering

4. Wheel Circuit Adjustment – *this should only be done when fitting new replacement parts or later additions as the original system has been fully pre-commissioned and is ready for use.*

- 4.1. Switch on the power, and set the Wheel as near as possible in the dead ahead position. Connect the meter to one of the Meter- test points and to the Wheel 1 Meter+ test point.
 - a) With the wheel dead ahead, set the CEN control for 2.50V
 - b) With the wheel full port, set the SPAN control for 1.00V
 - c) If the rudder voltage rises when swinging to port, swap the Wheel Stbd and Wheel Port connections where the Wheel cable enters the Selector Box.
 - d) With the wheel full starboard, observe the difference between the actual voltage and 4.00
 - Adjust the CEN control to remove half the difference.
 - Adjust the SPAN control to remove the rest of the difference.
 - e) Check that the voltage on full port is between 0.95 and 1.05 .
 - f) If the full port voltage is outside these limits, use the CEN control to remove half the error and the SPAN control to remove the rest. The setting can then be checked at full starboard, starting from step d). This process should rapidly converge to the point where the test point voltage at both ends of the wheel swing is correct.
 - g) If Steer Stations 2 or 3 are fitted, repeat the procedure for these facilities.

5. Angle Indicator Adjustments – *this should only be done when fitting new replacement parts or later additions as the original system has been fully pre-commissioned and is ready for use.*

- 5.1. The Angle Indicators are all adjusted in the same manner. The procedure here is for Rudder 1.
- 5.2. Note that the indicator adjustments are located just above the Connector Board – do not at this stage touch the input adjustments on the left of the Main Board!
- 5.3. **Ensure that the hydraulic power pack is switched off and locked so that it cannot be started inadvertently.**
- 5.4. Disconnect the mechanical link between the rudder 1 transducer and the tiller arm, so that the transducer arm can be positioned by hand.
- 5.5. Set the transducer to the dead ahead position, and use the Rudder 1 Indicator Centre adjustment (see the photo on page 10) to bring the indicator to the dead ahead position.
- 5.6. Set the transducer to hard-over starboard, and use the Span adjustment to bring the indicator to the appropriate angle (usually 35°).
- 5.7. Set the transducer to hard-over port, then use the Centre adjustment to remove half the error, and the Span adjustment to bring the indicator to the correct angle.
- 5.8. Go back to hard-over starboard, and repeat, using Centre for half the correction and Span for the rest.
- 5.9. The indicator adjustments should converge so that the end-points are both correct.
- 5.10. Finally check the dead-ahead position. If this is significantly incorrect, investigate the transducer and its linkage for non-linearity.

HyDrive ES-805 Commander Electronic Steering

- 5.11. When satisfied, re-connect the mechanical link between the rudder transducer and the tiller arm. **Carry out a security inspection on the rudder and transducer mechanics in accordance with your company procedures.**
- 5.12. The hydraulic power pack can now be returned to commission.

Specifications

1. Power Input:
+11 to +32 Vdc
Current: not more than 250 mA (steering active) plus solenoid current.
2. Steer Stations:
Hy-Drive ES-801C or equivalent.
Cable Length: 50 metres max.
3. Rudder Transducers:
Type: Potentiometric
Resistance: 0.5 to 10 Kohm
Excitation: 9.5 ± 0.2 V
Angle: $\pm 35^\circ$ nominal on a 350° potentiometer
Cable Length: 50 metres max.
4. Solenoid Outputs:
Max working voltage: + 33 Vdc
Max current: 2.5 A per solenoid
Protection: Surge arrestor diodes plus fast flyback diodes.
5. Joystick:
Excitation: 9.5 V nominal
Load Current: 2 mA
6. EMC EN60945 (Bridge Mounted Navigational Equipment)
7. Control Diagram Capacity 250 Function Blocks of any type
8. Dimensions:
Height: 55 mm above mounting plane, including connectors but not allowing for field wiring.

Width: 192 mm max

Depth: 150 mm max
9. Ambient temperature: -10 to +60 °C

HyDrive ES-805 Commander Electronic Steering

WARNING SAFETY-CRITICAL SYSTEMS

A Safety-Critical system is a system whose failure or malfunction could cause death, significant injury or loss of property.

HyDrive/AmbiLogique products incorporate electronic hardware and software, both of which carry a remote but real possibility of failure. HYDRIVE DOES NOT WARRANT, CLAIM OR REPRESENT THAT ITS PRODUCTS ARE INFALLIBLE.

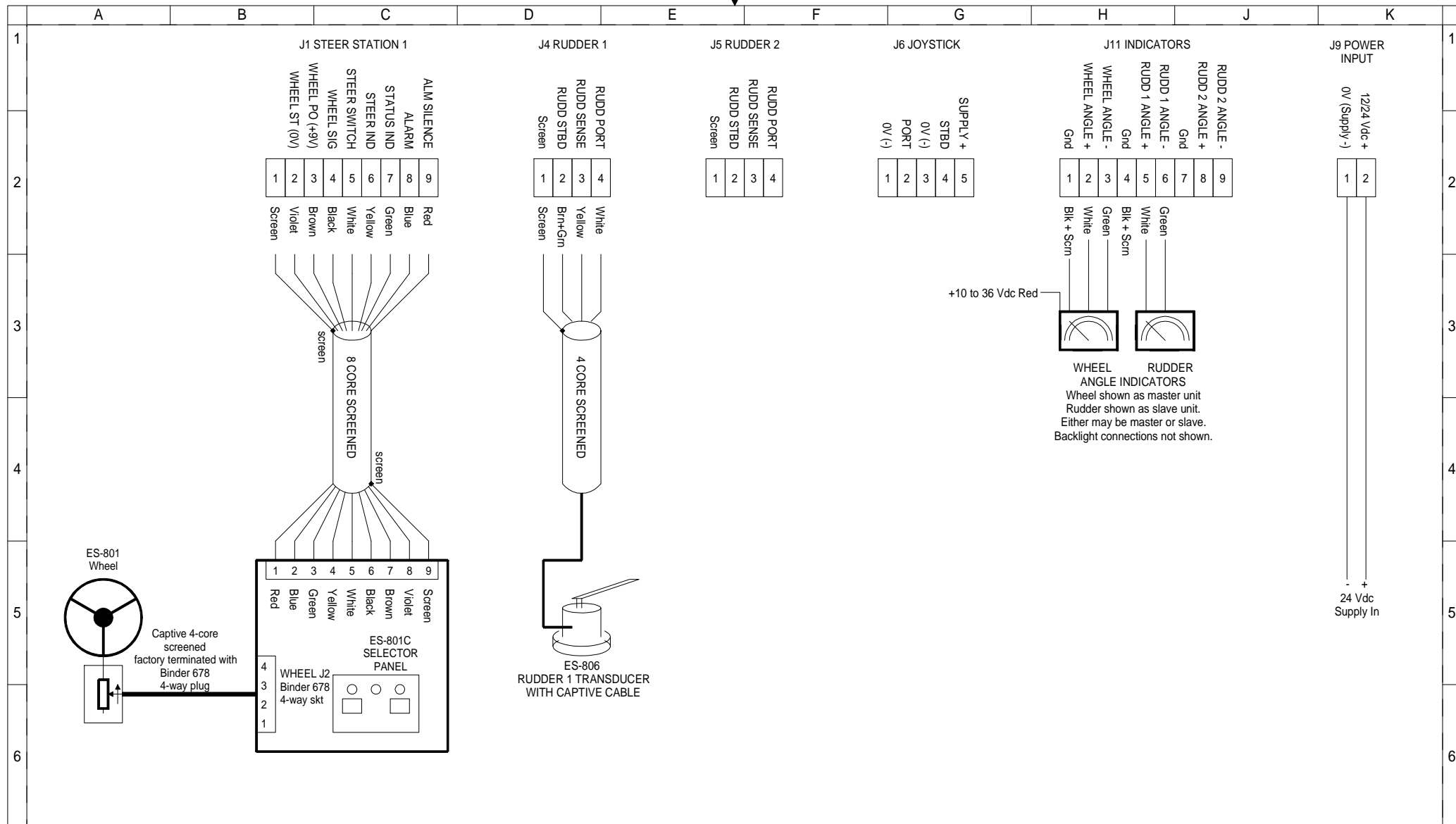
It is therefore THE RESPONSIBILITY OF THE USER/INSTALLER of any safety-critical system which incorporates HyDrive/AmbiLogique products to ensure that:-

1. .At least one other form of steering the vessel be included in the boat design. This could be means of an independent joystick, autopilot with dodge type controls or by mechanical means including control by dual engines for emergency manoeuvring.
2. No less than two DC power supplies be provided and available for use with the steering system to ensure that DC failure does not render the system without power or control.
3. Have the means of isolating the steering system's power at the bridge or steering position. This should be a form of switch which should be clearly marked and turned off in the event that steering control is lost so as to allow the control then to be taken by you back-up alternatives.
4. Maintain active watch on the bridge or steering station at all times and do not leave the steering unattended for any period of time. This is standard safety procedure for vessels at sea.

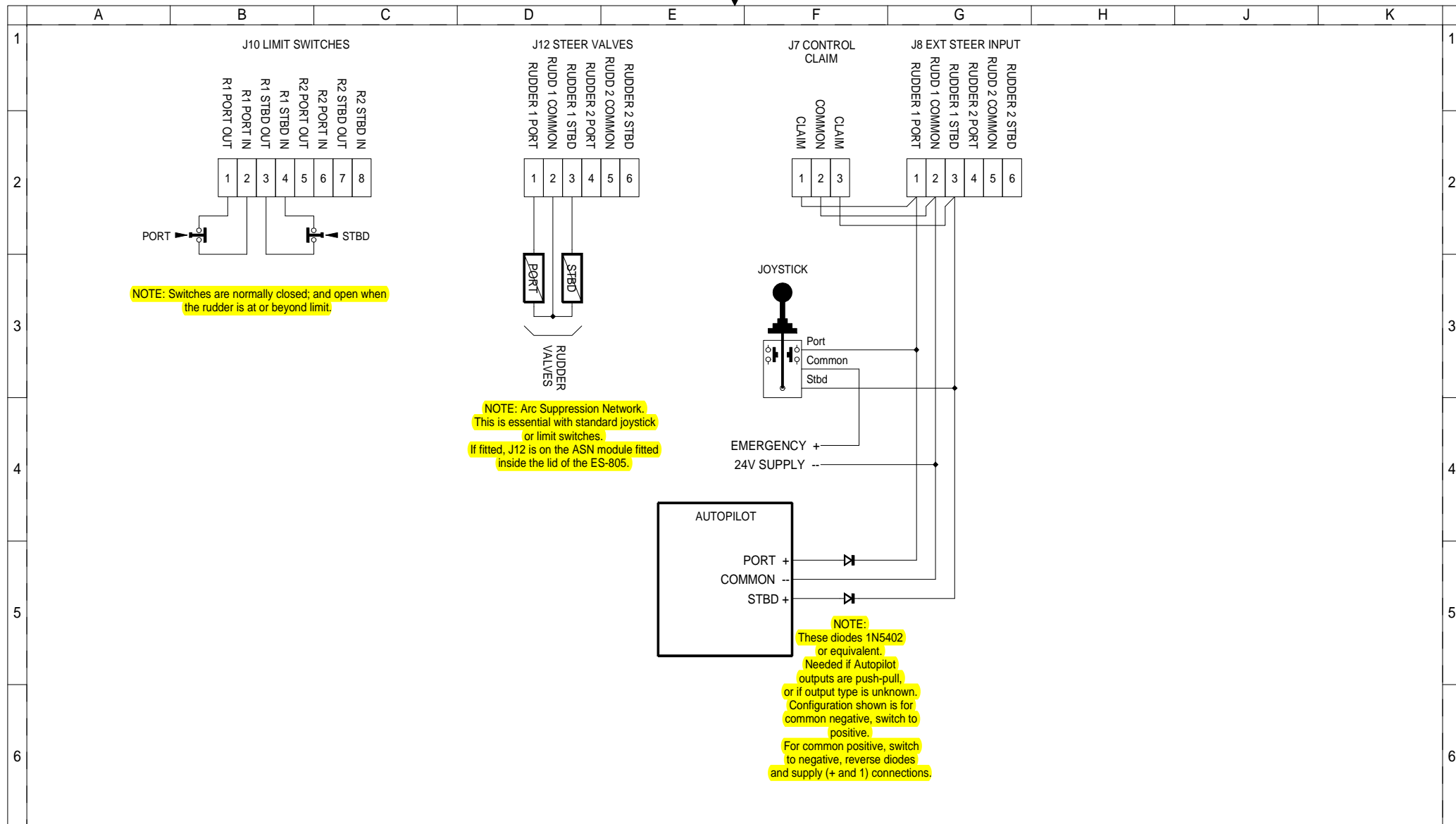
Revision History:

R 0.0 2012-07-27 Initial issue.

| | A | B | C | D | E | F | G | H | J | K | | | | | | | |
|---|--|---|---|---|---|---|---|---|---|--|--|---|---|---|---|--|---|
| 1 | J1 STEER STATION 1 | | | | J8 EXT STEER INPUT | | CONFIGURATION SWITCHES | | | FAULT CODES | | 1 | | | | | |
| 2 | <div>ALM SILENCE</div> <div>ALARM</div> <div>STATUS IND</div> <div>STEER IND</div> <div>STEER SWITCH</div> <div>WHEEL SIG</div> <div>WHEEL PO (+9V)</div> <div>WHEEL ST (0V)</div> <div><div><div>9</div><div>8</div><div>7</div><div>6</div><div>5</div><div>4</div><div>3</div><div>2</div><div>1</div></div><div><div>Red</div><div>Blue</div><div>Green</div><div>Yellow</div><div>White</div><div>Black</div><div>Brown</div><div>Violet</div><div>Screen</div></div></div> | | | | <div>J4 RUDDER 1</div> <div>RUDD PO</div> <div>RUDD SIG</div> <div>RUDD ST</div> <div><div><div>4</div><div>3</div><div>2</div><div>1</div></div><div><div>White</div><div>Yellow</div><div>Brown+Green</div><div>Screen</div></div></div> | | <div>J6 JOYSTICK</div> <div>Supp+</div> <div>STBD</div> <div>0V (-)</div> <div>PORT</div> <div>0V (-)</div> <div><div><div>5</div><div>4</div><div>3</div><div>2</div><div>1</div></div><div><div>Red</div><div>Green</div><div>Brown</div><div>Yellow</div><div>White</div></div></div> | | | <div>J8 EXT STEER INPUT</div> <div>EXT SOL 2 STBD</div> <div>EXT SOL 2 COM</div> <div>EXT SOL 2 PORT</div> <div>EXT SOL 1 STBD</div> <div>EXT SOL 1 COMM</div> <div>EXT SOL 1 PORT</div> <div><div><div>6</div><div>5</div><div>4</div><div>3</div><div>2</div><div>1</div></div><div><div></div><div></div><div></div><div></div><div></div><div></div></div></div> | | <div>ON</div> <div><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div><div><div>1</div><div>2</div><div>3</div><div>4</div><div>5</div><div>6</div><div>7</div><div>8</div></div></div><div><div>reserved</div><div>reserved</div><div>reserved</div><div>RUDDER 2 ENABLE</div><div>RUDDER 1 ENABLE</div><div>reserved</div><div>DEADBAND</div><div>DEADBAND</div></div></div> | | | <div>FAULT CODES</div> <div>Faults are indicated by the number of 'beeps' and the number of dips in the status indicators:-</div> <div>5 = Wheel Fault (open or short circuit).</div> <div>4 = Rudder 1 Fault (open or short circuit).</div> <div>3 = Servo 1 Fault (hydraulic lock).</div> <div>2 = Rudder 2 Fault (open or short circuit).</div> <div>1 = Servo 2 Fault (hydraulic lock).</div> | | 2 |
| 3 | J2 STEER STATION 2 | | | | J10 LIMIT SWITCHES | | DEAD BAND | | | RUDDER ENABLE | | 3 | | | | | |
| 4 | <div>ALM SILENCE</div> <div>ALARM</div> <div>STATUS IND</div> <div>STEER IND</div> <div>STEER SWITCH</div> <div>WHEEL SIG</div> <div>WHEEL PO (+9V)</div> <div>WHEEL ST (0V)</div> <div><div><div>9</div><div>8</div><div>7</div><div>6</div><div>5</div><div>4</div><div>3</div><div>2</div><div>1</div></div><div><div>Red</div><div>Blue</div><div>Green</div><div>Yellow</div><div>White</div><div>Black</div><div>Brown</div><div>Violet</div><div>Screen</div></div></div> | | | | <div>J5 RUDDER 2</div> <div>RUDD PO</div> <div>RUDD SIG</div> <div>RUDD ST</div> <div><div><div>4</div><div>3</div><div>2</div><div>1</div></div><div><div>White</div><div>Yellow</div><div>Brown+Green</div><div>Screen</div></div></div> | | <div>J10 LIMIT SWITCHES</div> <div>RUDD 2 STBD</div> <div>RUDD 2 STBD</div> <div>RUDD 2 PORT</div> <div>RUDD 2 PORT</div> <div>RUDD 1 STBD</div> <div>RUDD 1 STBD</div> <div>RUDD 1 PORT</div> <div>RUDD 1 PORT</div> <div><div><div>8</div><div>7</div><div>6</div><div>5</div><div>4</div><div>3</div><div>2</div><div>1</div></div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div></div> | | | <div>DEAD BAND</div> <div>0.6°</div> <div>0.9°</div> <div>1.4°</div> <div>2.0°</div> <div><div><div><div></div><div></div></div><div><div></div><div></div></div></div><div><div>1</div><div>2</div></div><div><div><div></div><div></div></div><div><div></div><div></div></div></div><div><div>1</div><div>2</div></div><div><div><div></div><div></div></div><div><div></div><div></div></div></div><div><div>1</div><div>2</div></div><div><div><div></div><div></div></div><div><div></div><div></div></div></div><div><div>1</div><div>2</div></div></div> | | | <div>RUDDER ENABLE</div> <div>Disable</div> <div>Enable</div> <div><div><div></div><div></div></div><div><div></div><div></div></div></div> <div><div>4 or 5</div><div>4 or 5</div></div> | | 4 | | |
| 5 | J3 STEER STATION 3 | | | | J9 DC POWER | | J12 STEER VALVES | | | | | 5 | | | | | |
| 6 | <div>ALM SILENCE</div> <div>ALARM</div> <div>STATUS IND</div> <div>STEER IND</div> <div>STEER SWITCH</div> <div>WHEEL SIG</div> <div>WHEEL PO (+9V)</div> <div>WHEEL ST (0V)</div> <div><div><div>9</div><div>8</div><div>7</div><div>6</div><div>5</div><div>4</div><div>3</div><div>2</div><div>1</div></div><div><div>Red</div><div>Blue</div><div>Green</div><div>Yellow</div><div>White</div><div>Black</div><div>Brown</div><div>Violet</div><div>Screen</div></div></div> | | | | <div>J11 ANGLE INDICATORS</div> <div>RAI 2 -</div> <div>RAI 2 +</div> <div>Gnd</div> <div>RAI 1 -</div> <div>RAI 1 +</div> <div>Gnd</div> <div>WAI -</div> <div>WAI +</div> <div>Gnd</div> <div><div><div>9</div><div>8</div><div>7</div><div>6</div><div>5</div><div>4</div><div>3</div><div>2</div><div>1</div></div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div></div> | | <div>J9 DC POWER</div> <div>SUPPLY +</div> <div>SUPPLY -</div> <div><div><div>2</div><div>1</div></div><div><div></div><div></div></div></div> | | | <div>J12 STEER VALVES</div> <div>PP SOL 2 STBD</div> <div>PP SOL 2 COMM</div> <div>PP SOL 2 PORT</div> <div>PP SOL 1 STBD</div> <div>PP SOL 1 COMM</div> <div>PP SOL 1 PORT</div> <div><div><div>6</div><div>5</div><div>4</div><div>3</div><div>2</div><div>1</div></div><div><div></div><div></div><div></div><div></div><div></div><div></div></div></div> | | | | | 6 | | |
| <div>REVCHANGEDRNCHKDDATE</div> <div>2.0Layout as physical panel.RJW12 Feb 2012</div> <div>1.1J1-3 connections reversedRJW04 Sep 2009</div> | | | | | | | | | | | | <div>Hy-Drive Engineering Pty Ltd</div> <div>Wingfield SA 5013</div> | | <div>TITLESTEER BY WIRE PCB</div> <div>Terminal Diagram</div> <div>DRG. No. HYD-T08</div> <div>sheet 1 of 1</div> | | | |



| REV | CHANGE | DRN | CHKD | DATE | Hy-Drive Engineering Pty Ltd Wingfield South Australia 5013 | TITLE STEER BY WIRE Pack 1 Hookup | |
|------|--|-----|------|-------------|--|--------------------------------------|--------------|
| 3.0 | A/Pilot & Emg Steer connections updated. | RJW | | 2013-10-22 | | DRG. No. ALS-H08A | sheet 1 of 2 |
| 2.0A | Stripped version for Pack 1 (basic starter kit). | RJW | | 2012-08-21 | | | |
| 2.0 | Layout revised. | | | 08 Sep 2011 | | | |



| REV | CHANGE | DRN | CHKD | DATE | Hy-Drive Engineering Pty Ltd Wingfield South Australia 5013 | TITLE STEER BY WIRE | |
|------|--|-----|------|--------------|--|---------------------|--|
| 3.0 | A/Pilot & Emg Steer connections updated. | RJW | | 2013-10-22 | | Pack 1 Hookup | |
| 2.0A | Revised for Pack 1 (basic starter kit). | RJW | | 22 July 2009 | | DRG. No. ALS-H08A | |
| 2.0 | Layout revised. | RJW | | 13 Feb 2012 | | sheet 2 of 2 | |

HyDrive E-Series main junction box

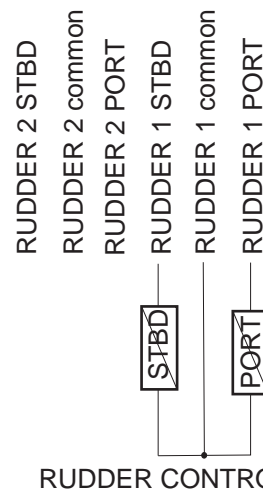
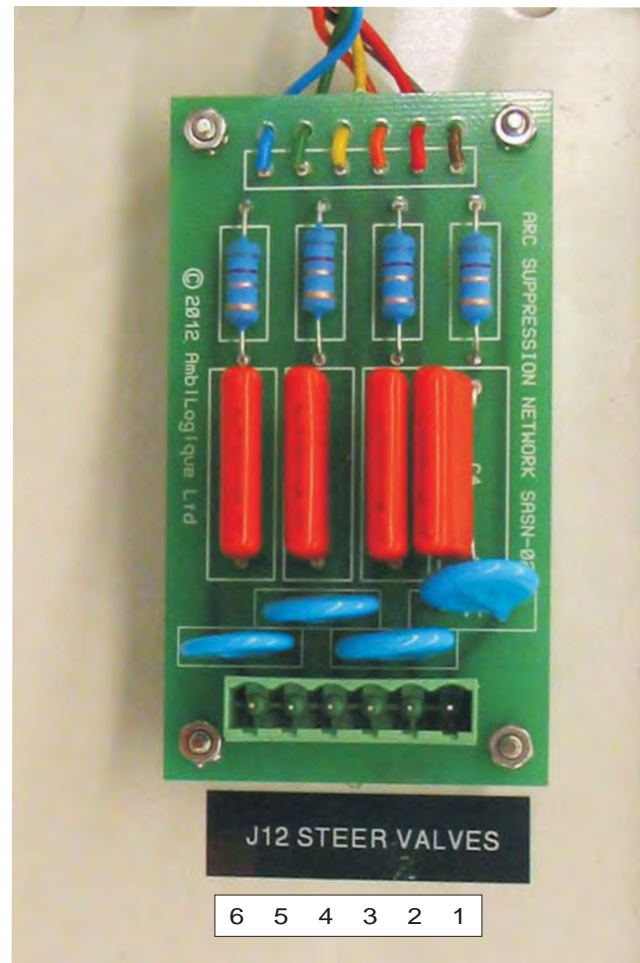


In open position showing the new Arc Suppression Network card position



Arc Suppression Network Card

This is located on the inside lid of the ES-805 Controller Junction-Box



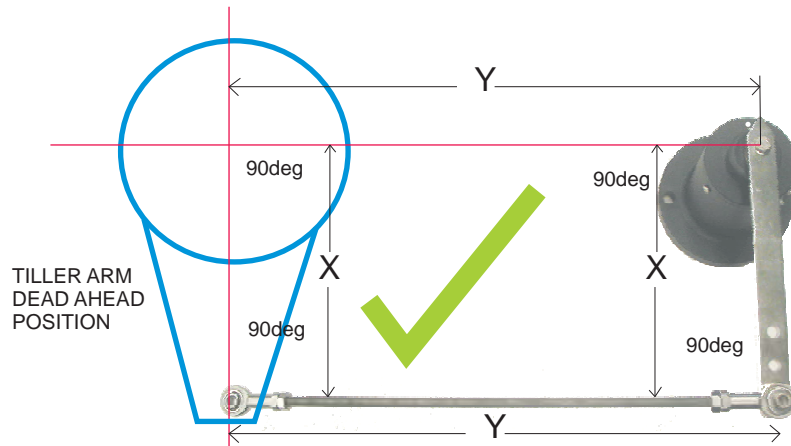
WIRING CONNECTIONS TO SOLENOID VALVES SHOULD BE MADE AS SHOWN.

Where dual solenoids are used in conjunction with electronic synchronisation of twin independent rudders, then the second solenoid is connected to RUDDER 2 position in the same way as for RUDDER 1.

Single rudders must always use ONLY the terminals for RUDDER 1

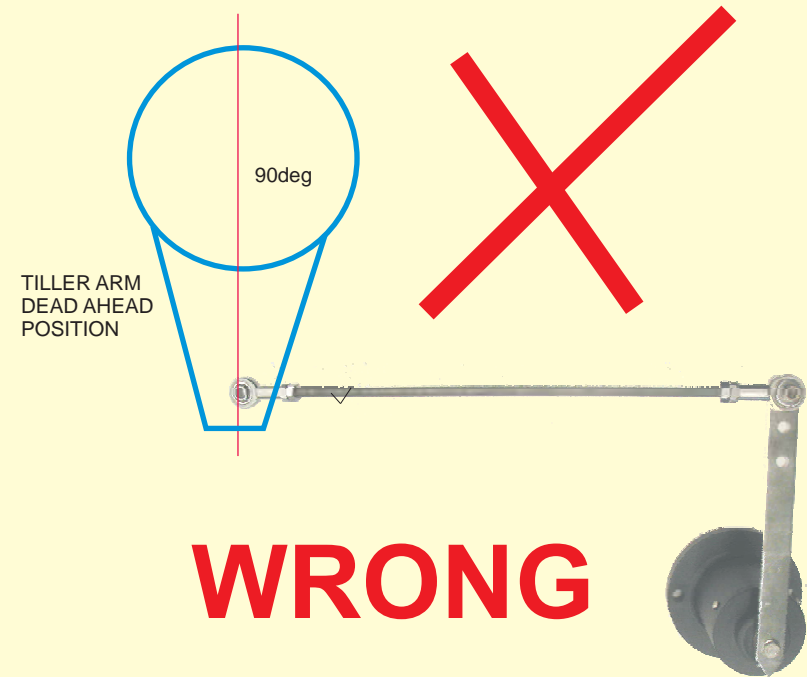
This device is designed to prevent fly-back voltage spikes caused by activation and de-activation of the steering solenoid coils by such devices as self-powered joysticks and autopilot. As these spikes can vary from one type of valve to another, and increase according to the voltage of the system (12-24volts DC), this device simply gives a robust protection against damage that may be caused by the high release voltages.

TYPICAL RUDDER TRANSDUCER ARRANGEMENT FOR USE WITH E-SERIES STEERING OR RUDDER INDICATORS.



CORRECT

NOTE: The geometry is important to ensure that the correct rudder angle and movement is sensed and displayed. The lengths of the X & Y dimensions above must be the same as each other to ensure a parallelogram,

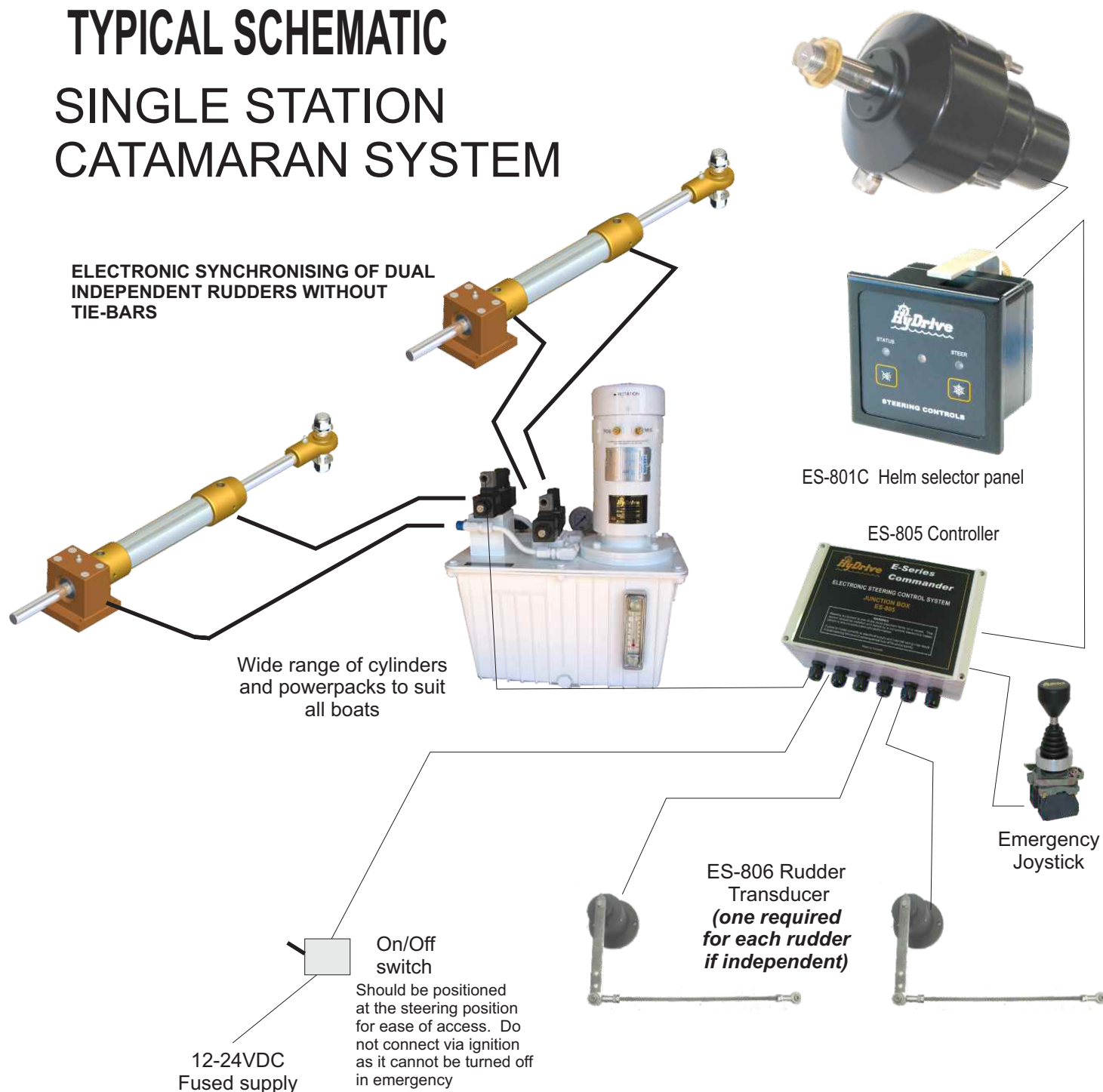


WRONG

**UNDER NO CIRCUMSTANCES
SHOULD THE RUDDER
TRANSDUCER BE FITTED
AS SHOWN ABOVE - IT
WILL DAMAGE THE TRANSDUCER
AND CAUSE STEERING FAILURE**

Commander

TYPICAL SCHEMATIC SINGLE STATION CATAMARAN SYSTEM

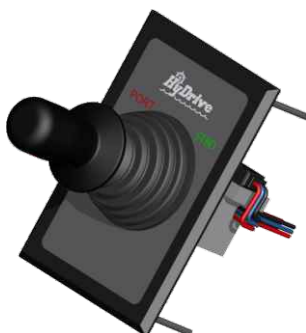


Optional Controls

ES-802 Mini helm unit - 270 deg



ES-807 Joystick



ES-803 Follow-up lever unit - 270 deg



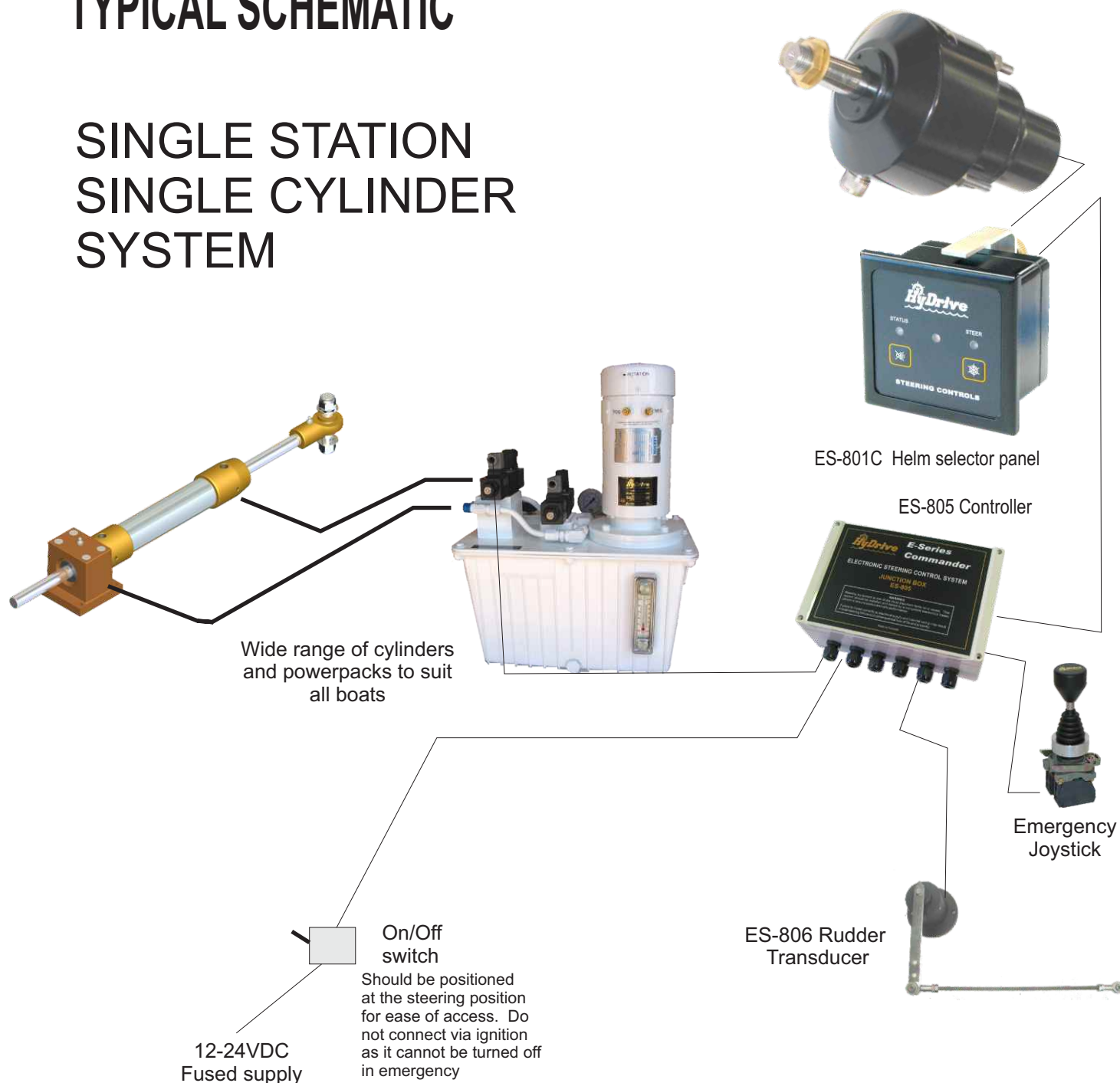
ES-804 Non Follow-up lever unit



Commander

TYPICAL SCHEMATIC

SINGLE STATION SINGLE CYLINDER SYSTEM

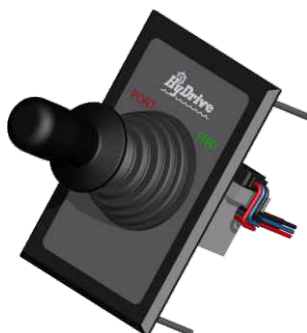


Optional Controls

ES-802 Mini helm unit - 270 deg



ES-807 Joystick



ES-803 Follow-up lever unit - 270 deg



ES-804 Non Follow-up lever unit



Commander

TYPICAL SCHEMATIC

DUAL STATION SINGLE CYLINDER SYSTEM



ES-801C Helm selector panel

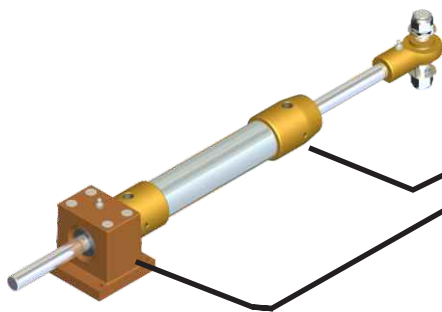


ES-801C Helm selector panel

ES-805 Controller



Emergency Joystick



Wide range of cylinders and powerpacks to suit all boats



On/Off switch

12-24VDC Fused supply

Should be positioned at the steering position for ease of access. Do not connect via ignition as it cannot be turned off in emergency

ES-806 Rudder Transducer



Additional station(s) can use any of the follow-up control options on previous page. Maximum of 3 follow up stations can be fitted of any type. Unlimited non-follow-up levers and joysticks can also be fitted in addition to the 3 follow-up positions.

STANDARD SPECIFICATIONS:-

BASIC E-SERIES STAND-ALONE STEERING SYSTEM

ENVIRONMENTAL: 0-50degC

STEERING COMPATIBILITY:- All solenoid activated power steering units.

AUTOPILOT:- All autopilots with solenoid drive outputs

POWER CONSUMPTION:- 300mAmps Control current. 2.5amps during solenoid activation

ES-801 COMMANDER HELM UNIT

CONSTRUCTION:- Heavy duty marine construction with stainless steel wheel shaft, high quality bearings and seals with adjustable wheel tension for heavy seas.

TURNS:- 3 turns lock to lock with limit stops

ES-801C HELM PANEL

FUNCTION:- Select helm position for use

DISPLAY:- LED indicator of power status and steer status.

ALARM:- LED indicator of alarm mode - varying frequency used for diagnostics.

DIMENSIONS:- 95mm x 95mm x 55mm

MOUNTING:- Panel Mount

CABLE:- .5M to helm plus 6M to J/Box. Other sizes available on request

ES-802 MINI HELM UNIT

CONSTRUCTION:- Compact design includes mini wheel.

TURNS:- 270degrees for 90 degree control

MOUNTING:- Panel mount - Square bezel optional

ES-803 FOLLOW UP LEVER

TURNS:- 90degrees for 90 degree control

DIMENSIONS:- 95mm x 150mm x 55mm

MOUNTING:- Panel mount

ES-804 NON FOLLOW UP LEVER

ACTION:- Spring centred joy-stick type action

DISPLAY:- LED's green and red for direction

DIMENSIONS:- 95mm x 150mm x 55mm

MOUNTING:- Panel mount

ES-805 CONTROLLER JUNCTION BOX

INPUT VOLTAGE:- 12v-24VDC

DIMENSIONS:- 250mm X 275mm x 55mm

MOUNTING:- Face fix

ES-806 RUDDER TRANSDUCER

CONSTRUCTION:- Heavy duty marine materials including stainless steel link arm. **Note: Two units are required for Independent synchronised rudder control.**

RAI-1 RUDDER ANGLE INDICATOR

INPUT VOLTAGE:- 12v-24VDC

DIMENSIONS:- 65mm dia

MOUNTING:- Panel mount

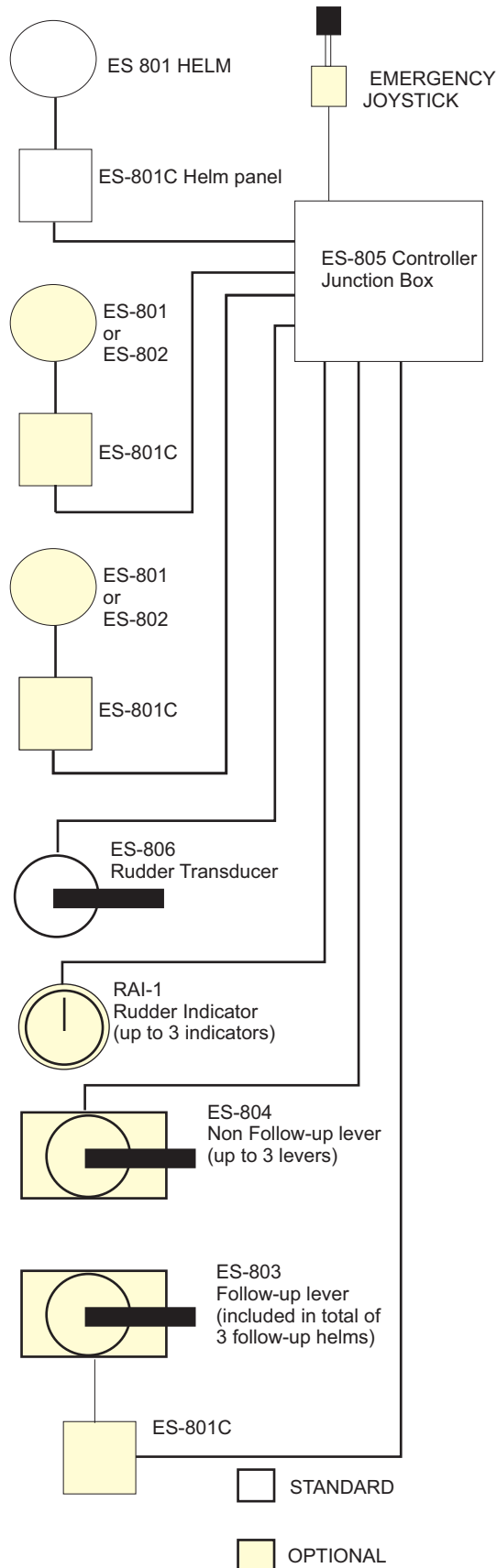
EMERGENCY JOYSTICK

Simple 2-directional joystick for panel mounting - supplied with 2 limit switches and special arc-suppression module to allow totally independent control of steering - even if main steering controller is deprived of power.

This option is recommended for single engine vessels where no alternative steering system is available



E-Series Commander



System compliant EN 60945 (EN 6100-4-3)



N17896

HYDRIVE ENGINEERING PTY LTD
59 Wingfield Road, WINGFIELD
South Australia 5013
Tel: 08 82431633 Fax 08 84457938
International: +61 8 82431633
Email: sales@hydrive.com.au
Web: www.hydrive.com.au