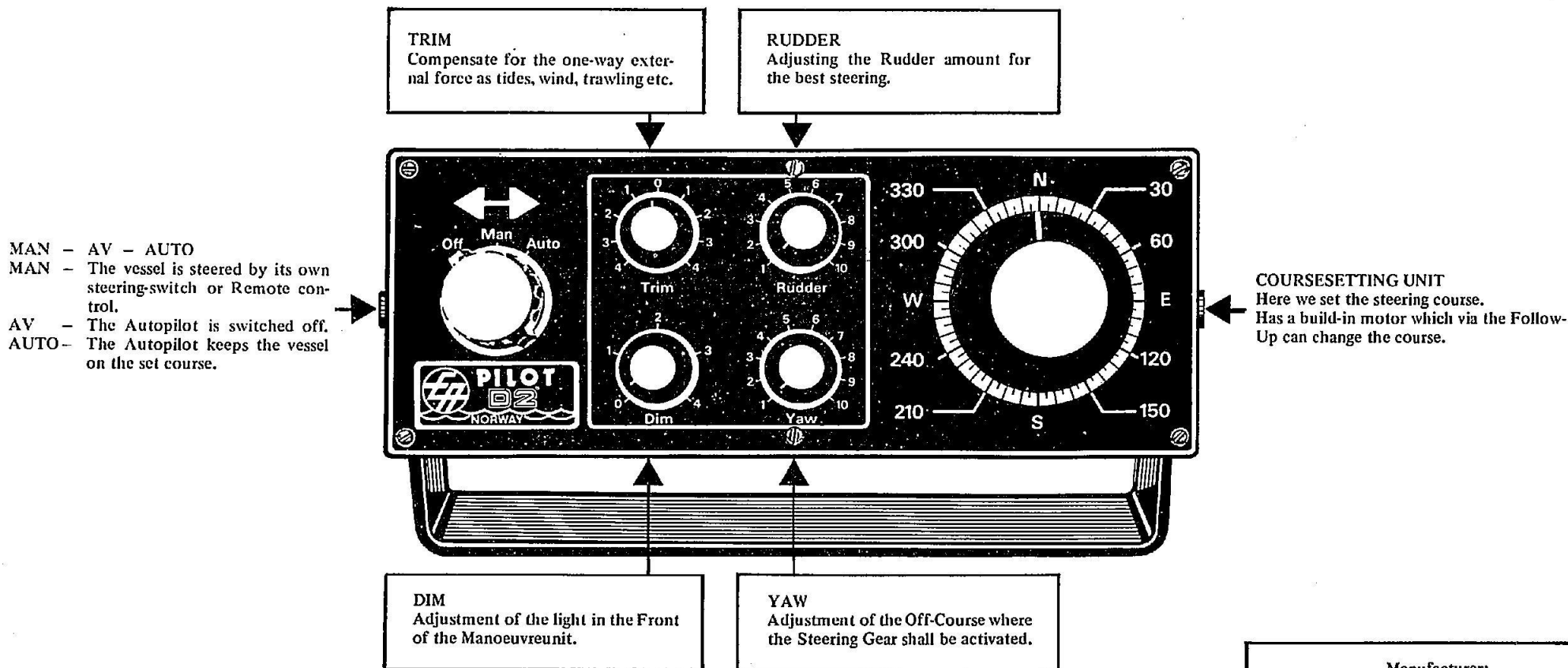


THE EA AUTOPILOT - TYPE D2

The D2 AUTOPILOT is a product of the experience reached through the C-pilot. The D2 is built up on modern integrated circuits which amongst others results in a very low use of effect and high reliability. The electronics are all on one card which makes the D2 very serviceminded. A new mechanical construction makes the Manoeuvreunit very resistant against blows and extreme climatic circumstances. The D2 AUTOPILOT is constructed for the professional fleet up till approx 80'.

The D2 AUTOPILOT has a real Follow-Up, which means that you can turn the Coursesetting-Unit with the Remote Control. The D2 can also be connected to most magnetic compasses and steering gears. The Front Panel Lighting is manuell operated. The Relay-Terminals are based on "Solid State Relays" which means that it is no-moving parts, and that the autopilot-signals to the magnetvalves goes via Beam of light. D2 has a minimum radiointerference.



THIS AUTOPILOT IS A PART OF
"THE NORWEGIAN STEERING AND NAVIGATION PACKAGE"

Distributor/Subagent:

Manufacturer:
A/S Electro Automation
5493 Kolbeinsvik, Norway.

Exclusive Supplier:



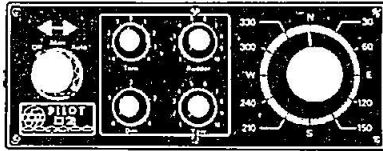
a/s el-trade

Hesselbergs gt. 8 - Oslo 5, Norway
Telex: 16 627 - Tlf.: (02) 35 11 60

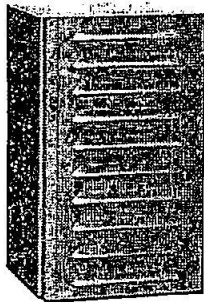
STANDARD

MANOEUVRE UNIT

Type D2

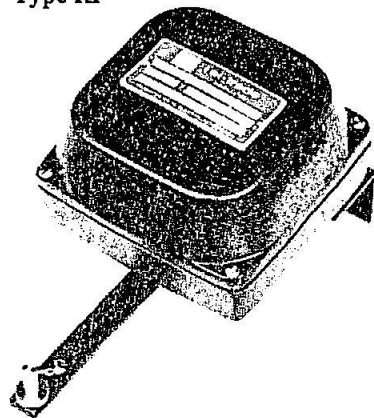


POWER BOX



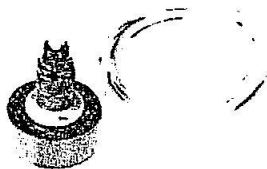
THE RUDDER TRANSLATOR

Type RF

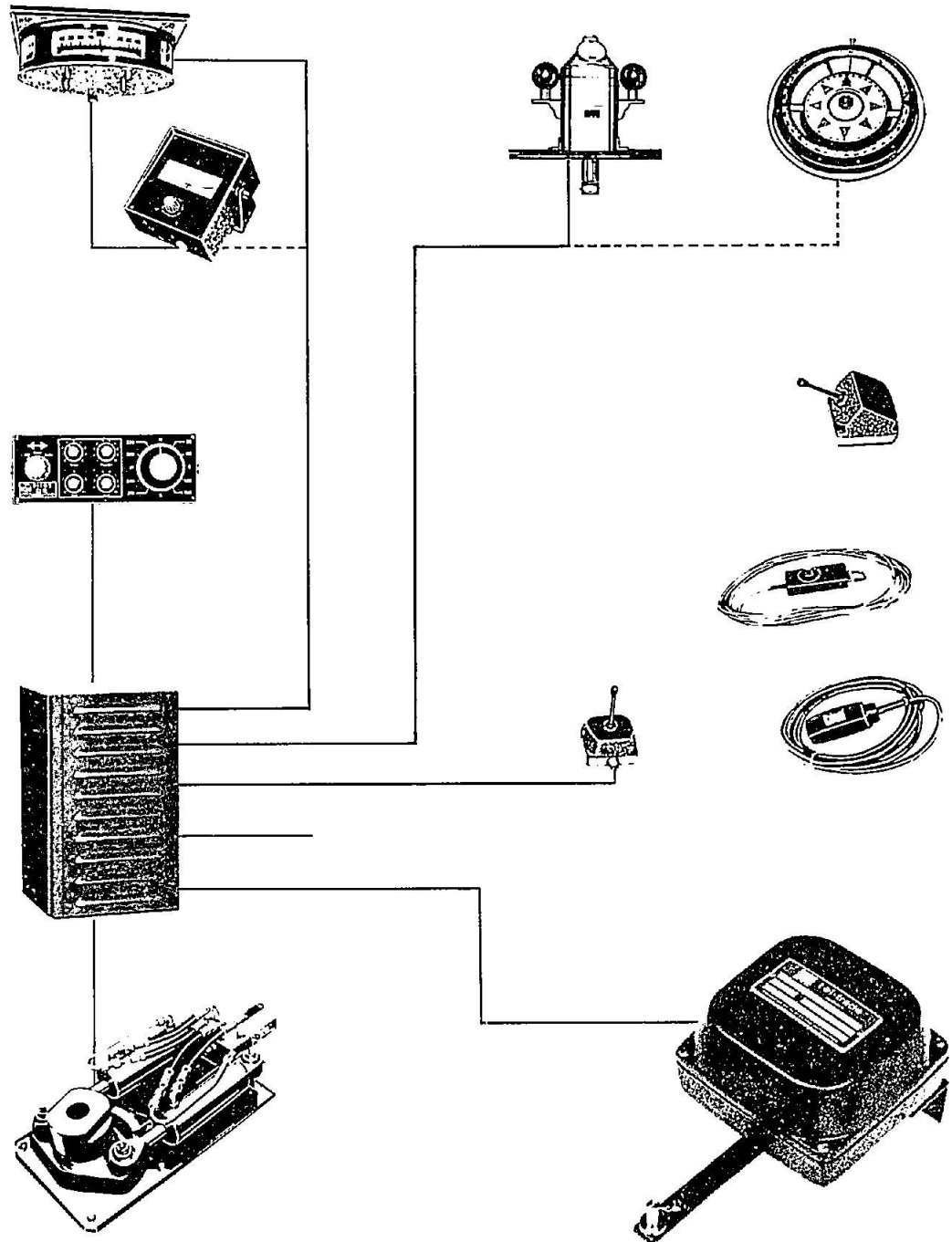


THE COMPASS TRANSDUCER

Type KF



THE NORWEGIAN STEERING AND NAVIGATION PACKAGE



TECHNICAL MANUAL FOR AUTOPILOT D2

PART 1

GENERAL INFORMATION.

- 1.1. EA-Pilot, type D2, is suitable for smaller vessels, ie. pleasure craft, small fishing vessel etc. On fast moving craft, there can be a problem and the positioning of the compass is of vital importance. Best results are normally obtained by using a heavy compass positioned near midship and low to the water line, but not too near large iron or steel objects.
- 1.2. D2 Pilot is designed primarily for use with hydraulic steering gear, with existing hand hydraulic systems it is only necessary to connect a small electrically driven pump (power pack) and the pilot will then be coupled to the magnetic solenoid valves. If a mechanical steering mechanism is employed, then the pilot should be connected via a relay box, which can be supplied as an optional extra.
- 1.3. Power Supplies
The pilot is designed to operate directly from 24 volts DC and current consumption is slightly less than 300 milliamps. The pilot's "solid state" relays can be coupled to either 12 or 24 volt DC operated magnetic solenoid valves, this is done directly without adjustments.
- 1.4. Compass
D2 can be used with most types compass but not the globe type, it is important that the compass has at least a 4" card for mechanical stability and to obtain a strong magnetic field.

PART 2

UNIT DESCRIPTION

2.1. Control Unit

The control unit contains all electronics including the "solid state" relays and power supplies.

continued/...

Main Switch

"OFF" switches off supply voltages within the pilot.

"MAN" allows the vessel to be steered by wheel, fixed station and portable remote controls.

"AUTO" The vessel will now steer onto the course as selected by the course setter, remote course setting can be done with switch on Auto.

Course Setter

This is the control for setting the desired course, the vessel will turn the same way as the course setter is rotated, very large adjustment should be limited to 170° at a time.

Dim - control the front panel illumination.

Yaw - controls the point where the vessel is considered off course and rudder is applied by the pilot to bring it back onto course, i.e. YAW.

Rudder - with a high setting a large amount of rudder is applied, adjustment of this control should be such that the vessel holds course with least rudder movement.

Trim - will normally be adjusted to mid. position, i.e. "0". This control is used for applying fixed rudder to compensate for wind or drag.

2.2. Connection Box

This is the main connection point for all cables (only the compass cable is not taken to this box). The 20 way multicable supplied by the factory is approx. 10 feet in length. This may be extended to 30 feet max. if needed. This box has available extra connection points for rudder indicator.

2.3. Rudder Translator

This unit contains 2 potentiometers, one is for the Pilot (direct coupled to the main spindle), the second is for rudder indicator (gear driven).

2.4. Compass Sensor

The compass sensor is normally glued to the underside of the compass, if it is not possible to mount it underneath then it may be mounted on top of the compass, the sense will then be such that a different connection will be needed, see 4.1.

2.5. Remote Control FS 600

This optional extra equipment is a very robust unit designed to be carried about. It is supplied with over 30 feet of cable, see section 2.6 for fixed station remote control.

2.6. Fixed Station Remote Controls FS320/FS330

FS 320 is for bulkhead mounting, FS330 for table top.
FS 320/330 can be used in place of the FS 600 but can also be directly connected to the steering gear (magnetic solenoid valves).

2.7. External Power Supplies

The pilot will function directly on a normal 24v DC supply system.

For 12V supplies an inverter must be used, this can be supplied as an optional extra.

For 110/220 volt AC a good quality power supply must be used, this can also be supplied as an optional extra.

For 32 volt DC supplies the pilot can be supplied from the factory for use on this voltage, but it must be specially ordered.

PART 3

INSTRUCTIONS FOR USE

3.1. Manual Steering (Main switch to MAN)

The D2 Autopilot can be used to manually steer the vessel by operating the magnetic solenoid valves. This is done either with an FS 600 remote control (portable with long cable lead) or with the FS 320 and FS 330 fixed station levers.

Set the main switch to "MAN".

With the remote control FS 600 it is now possible to steer the vessel, the red and green lamps will light as long as the steering gear is activated by the FS 600.

The remote control type FS 600 is the portable version, types FS320 and FS330 are fixed station units.

These remote controls are used such that if the main switch is set to "AUTO" it will be possible to alter the course of the vessel, see section 4.5 for side step connections of these remote controls.

NOTE: Only one portable remote must be used at a time, the portable remote is best moved around the vessel by using plug and sockets. The FS 600 is supplied with over 30 feet of cable.

For more detailed connections of remote controls see section 4.5.

3.2. Automatic Steering (Main switch to Auto)

The D2 Autopilot will hold the ships head to the course set on the course setter. The course can be altered by turning the course setter by hand or by turning the course setter with the remote

continued/...

control FS600.

- a. Set "TRIM" to mid. position, i.e. "0".
- b. Set "YAW" to a point between 2-3 for moderate sea, a little higher if the sea is rough.
- c. Set "RUDDER" to about 7.
- d. Select the course with the course setter, the vessel should now be steered onto course manually.
- e. Set main switch to "AUTO". The vessel will now hold this course.
- f. Adjust the "YAW" and "RUDDER" so that the vessel holds course while giving the least amount of rudder movement. Each vessel will have it's own steering characteristic so it will be necessary to experiment with these settings, but one will soon learn which setting is best.
- g. With side wind or drag it is possible to put in a fixed amount of rudder to compensate. This is done with the "TRIM" control.
- h. It is not necessary to steer the vessel onto course each time a new course is needed, just turn the "course selector" to the desired course and the vessel will take up the new course.

3.3. Automatic Steering with Remote Control

While the main switch is in "AUTO" the remote control does not have direct control on the rudder, but will change the course and remain on the new course. This allows for course changing from any position on the vessel. See par. 2.1.

PART 4.

INSTALLATION

4.1. Compass

If the compass with compass sensor already mounted has not been supplied by the factory then proceed as follows:-

Refer to drawing no. 2011D. The small brass cylinder is glued to the bottom of the compass using a two component epoxy glue (Araldite), remember to sand off paint work and make sure both cylinder and mounting surface are clean and free of oil/grease.

If it is not possible to mount the sensor under the compass it may be mounted on the glass top, in either case it is very important that the cylinder be centred as accurately as possible. The small indentation on the sensor is orientated to the steering marker of the compass. Note that the holes in the brass cylinder should be aligned to cater for this, in the case of Top Mounting the indentation should point 180° from the steering mark, i.e. towards the stern.

In either case the positioning of the sensor in the brass cylinder will be such that it is flush with the free end (furthest from the compass).

continued/...

Top mounting will require the above instructions to be followed and further the blue and black wire will be changed over when coupling in the control unit.

Remember the compass must be situated away from large magnetic or ferrous objects. The compass must swing freely in it's mount and in all directions, it is important to remember this and to take it into account when mounting the sensor.

The sensor cable should be looped under the compass so as to allow for free movement, a 6" to 8" loop will do. The sensor cable goes to the CONTROL UNIT where it is connected as shown in diagram 2011C, to points 21-26.

4.2. Rudder Translator

The rudder translator is mounted so that the movement of the rudder and rudder translator is 1:1, i.e. the radius from the centre of shafts to coupling pivot must be equal. See drawings 2011E and 2011C. The kit of parts supplied must be used and the coupling must be without slack.

Cable requirements - pilot and rudder indicator/6 way screened
- pilot only/3 way screened.

In the connection box there are available connection points for rudder indicator circuit.

4.3. Connection Box

This box may be mounted at any convenient point where all cables naturally meet, the 20 way cable from the control unit is over 3 yards long (standard supplied) but it may be extended up to 30 feet. (Avoid joining this cable).

4.4. Control Unit

This may be mounted by means of it's bracket in all positions. For panel mounting it is possible to order a bracket, see drawing 2011C and 2011H.

4.5. Remote Controls and Steering Gear

The portable remote control FS 600 must be connected directly to the connection box, see drawing 2011C. If it is necessary to move this remote control to other points on the vessel where the 30 feet of cable supplied cannot reach then it is recommended to use a plug and socket system, high quality components should be used and mounted so as to avoid any water penetration.

Control for fixed station mounting type FS320/330 can be connected directly to the connection box as the FS 600. If it is intended to use both then the fixed station control should be connected directly to the magnetic solenoid valves and the FS 600 to the connection box. In any type of connection, such as this, the FS320/330 must overrule the pilot when it is used, see drawing 2011.

For one fixed station control use ALT. 1 for connections.
For two fixed station controls use ALT. 2 for connection.

Sidestep Control

This will be available with control combination mentioned above, i.e. FS 600 connected to connection box and FS320/330 connected to the magnetic solenoid valves. The fixed station FS320/330 will then achieve the function and the FS 600 the remote course setting.

PART 5

ADJUSTMENTS

A good quality analog meter or digital voltmeter will be a requirement for this adjustment procedure, the later type of instrument is to be preferred.

- 5.1. Remove the front panel screws and pull out the main chassis, then locate the testpoints M1 and M2. These are located as shown in drawing 2011B.

ZERO volt reference is on connection strip no. 12 or the metal cases of transistors TR1 or TR2.

a. Rudder Translator Circuit

Adjust the rudder to it's mechanical centre, connect volt meter to M1 with voltmeter minus to lv then adjust P7 for zero voltage.

If it is decided to use a none standard type rudder translator potentiometer then P6 must be adjusted so that at M1 the voltage will correspond to 130 millivolts per degree of rudder.

If it is found that the front panel control gives too little rudder control then this may be correct by adjusting P9 anti-clockwise.

5.2. Compass and Course Setter

- a. Voltmeter to M2 with voltmeters minus to 0v. Turn the course setter until the voltmeter indicates 0 volts. As there are two zero points in the 360° of the course setter control, the correct position is when the voltmeter indicates a positive going voltage as the course setter is rotated clockwise.

When the correct point is found and the course setter adjusted to obtain 0v, the course setter knob is slackened and turned so that it's scale agrees with the compass. To slacken the knob remove the knob cover.

continued

NB. Do not retighten the knob so that it scrapes against the front panel.

- b. Adjust course setter 20° off course in clockwise direction. The voltmeter should now indicate about 0,52 volt. If the voltage is too high adjust P9 in clockwise direction until it indicates 0,52v.

If the reading is too low adjust P9 until it indicates 0,52v. In certain cases where the magnetic field is too weak the compass sensor must be moved closer to the compass. If this is done then recheck point 5.2a.

5.3. Rudder - Limit

Switch off hydraulic pump.

Function switch to "AUTO".

"Rudder" to max.

Adjust course setter 90° off course to starboard.

The green lamp should now be on.

Turn the rudder by hand until it reaches max. Then take it back a few degrees.

Adjust P11 until the green lamp goes out (clockwise). Then adjust the course setter 90° off course to port.

The red lamp will now be on.

Turn the rudder and adjust P12 so that the red lamp goes off.

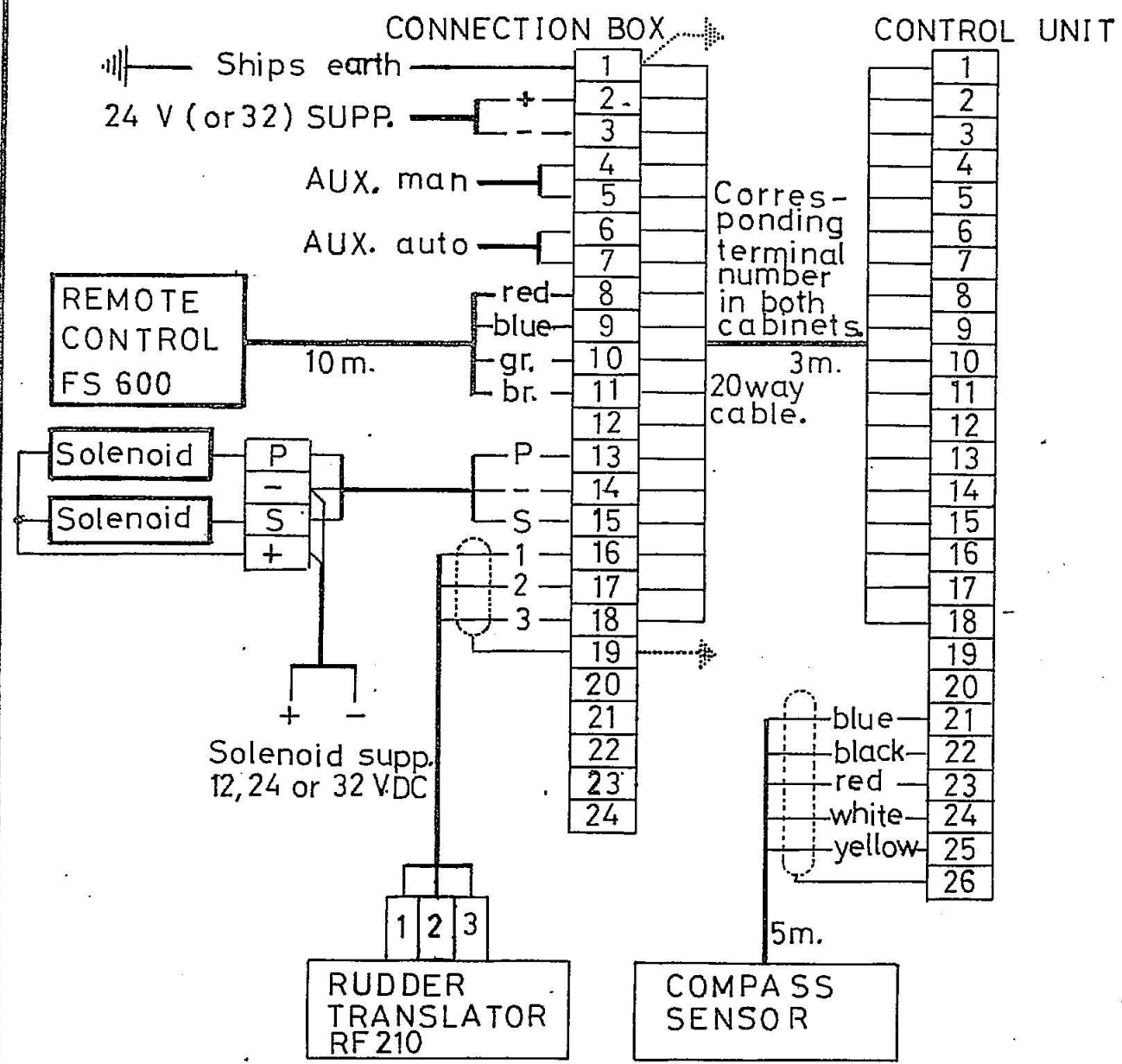
Adjust range of P11 and P12 cater for $\pm 45^{\circ}$ of rudder, with P11.P12 adjusted max. clockwise there will be NO rudder LIMIT.

5.4. Hysteresis

P10 is normally preset at the factory, it should only require readjustment if the following occurs:

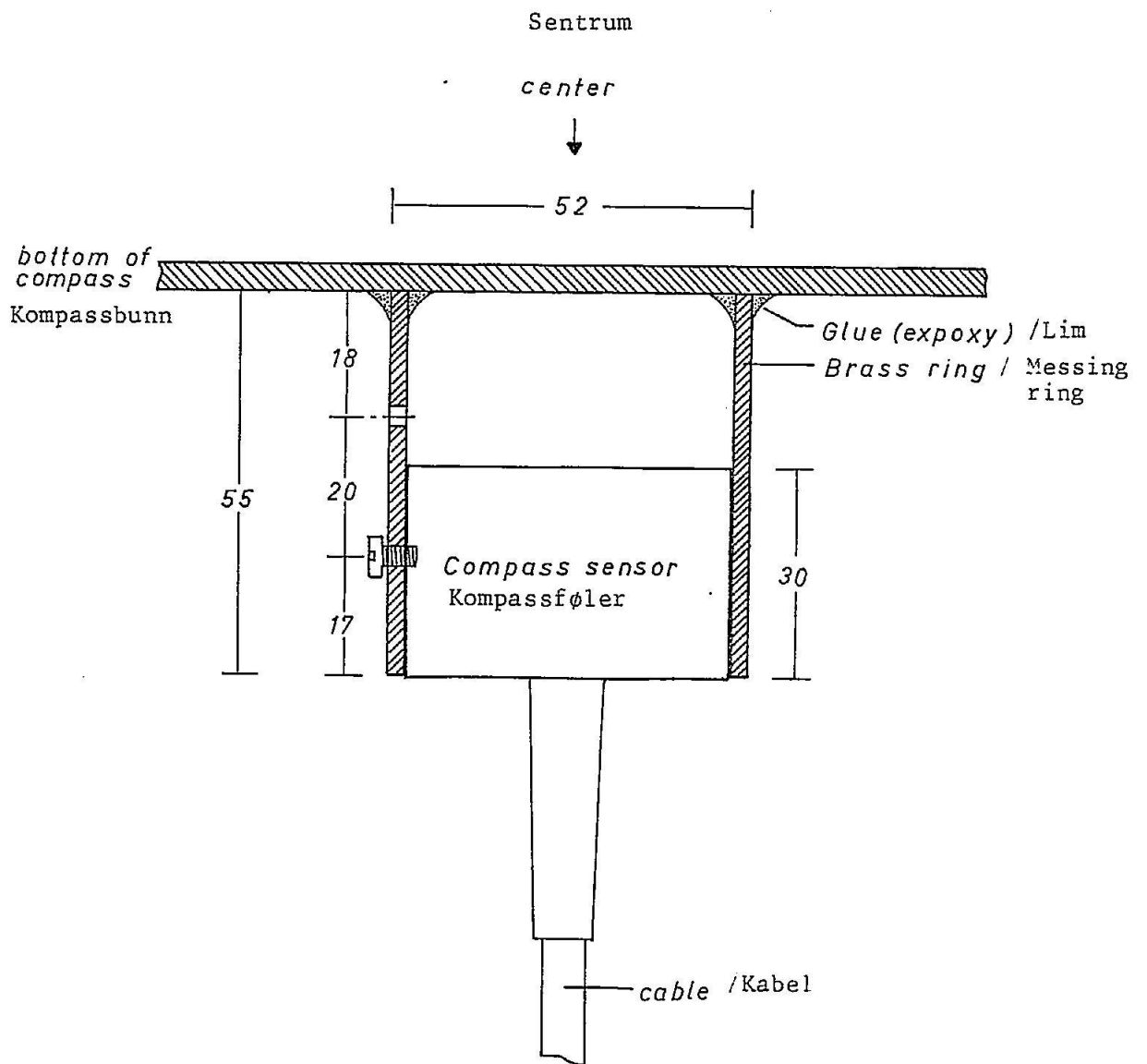
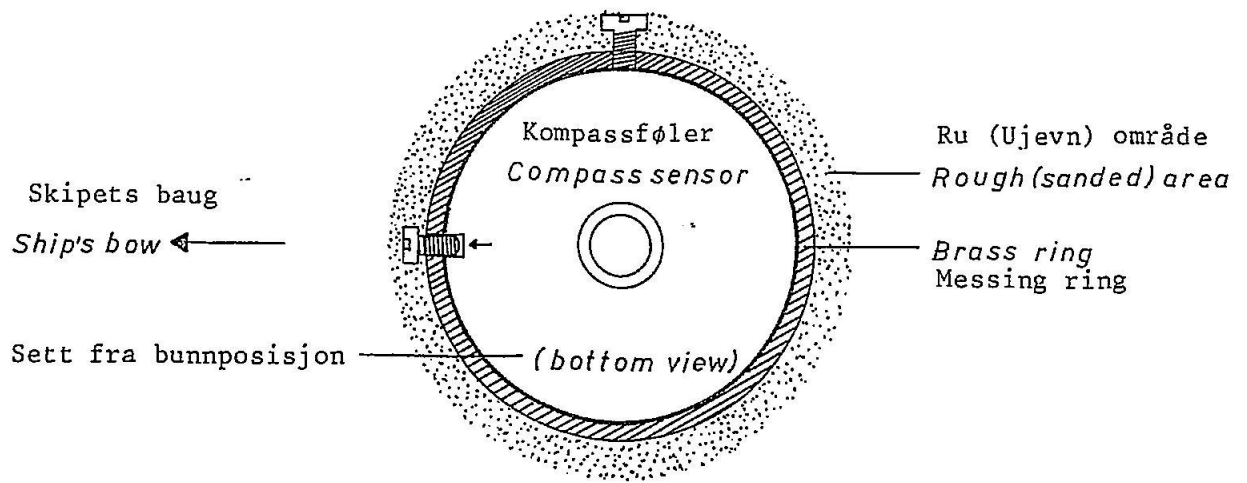
The vessel will be tied along the dock, "YAW" and "RUDDER" are set to a minimum, adjust the course setter 2-3 $^{\circ}$ off course the rudder should now oscillate, adjust "YAW" and "RUDDER" to 2 and 4-6 respectively, the rudder should now stop oscillating.

If the rudder does NOT stop oscillating then adjust P10 clockwise until it does. Should it still be difficult to stop the rudder oscillating it would indicate a slack in the connection (mechanically) between the rudder stock and rudder translator, or with hydraulics the pressure could be too high and may have to be reduced.

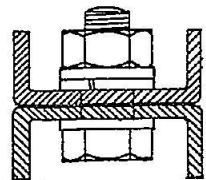
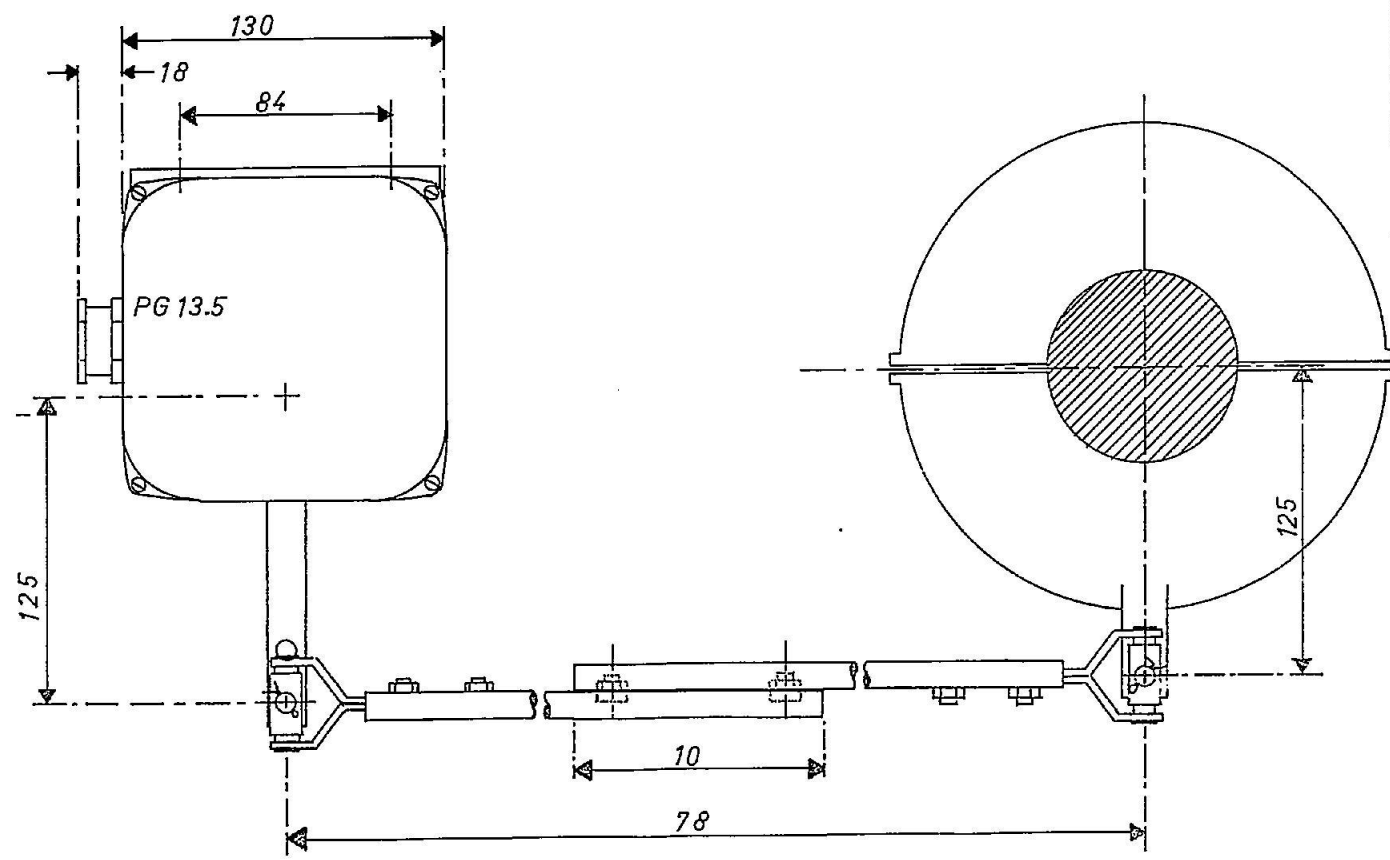
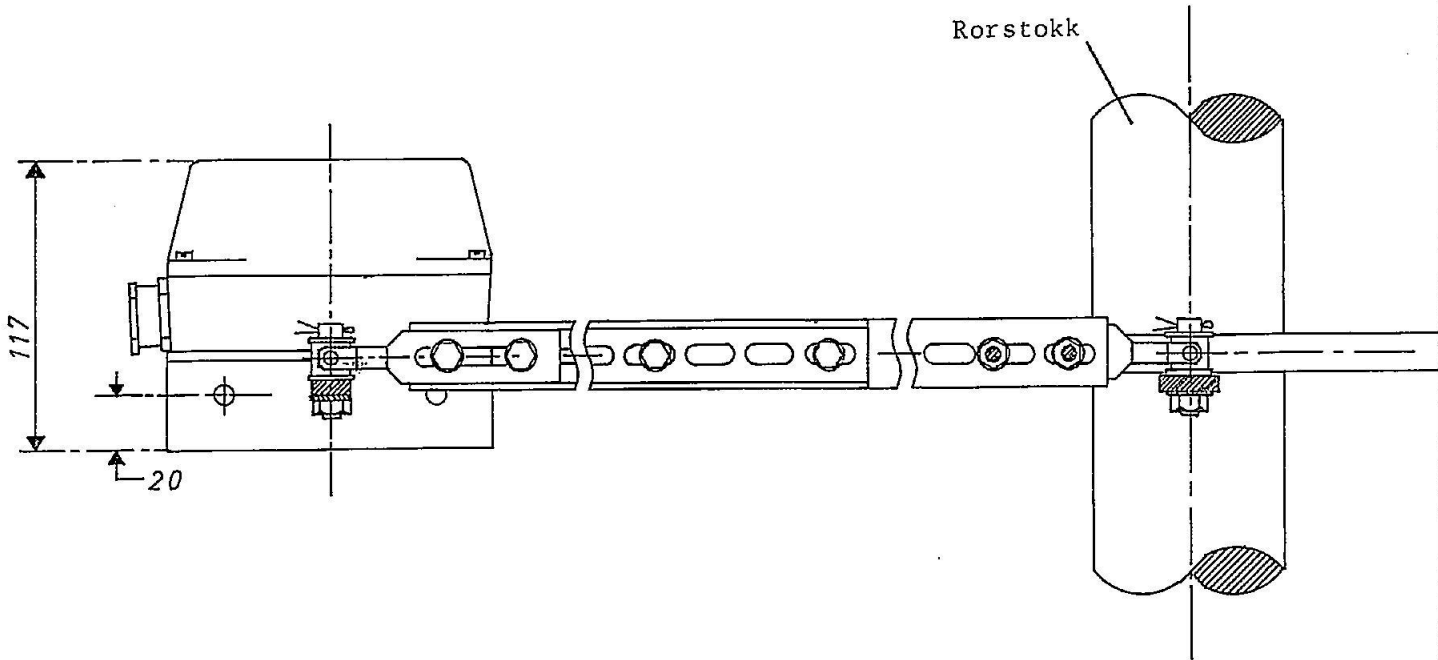


Terminals 20-24
for rudder indicator.

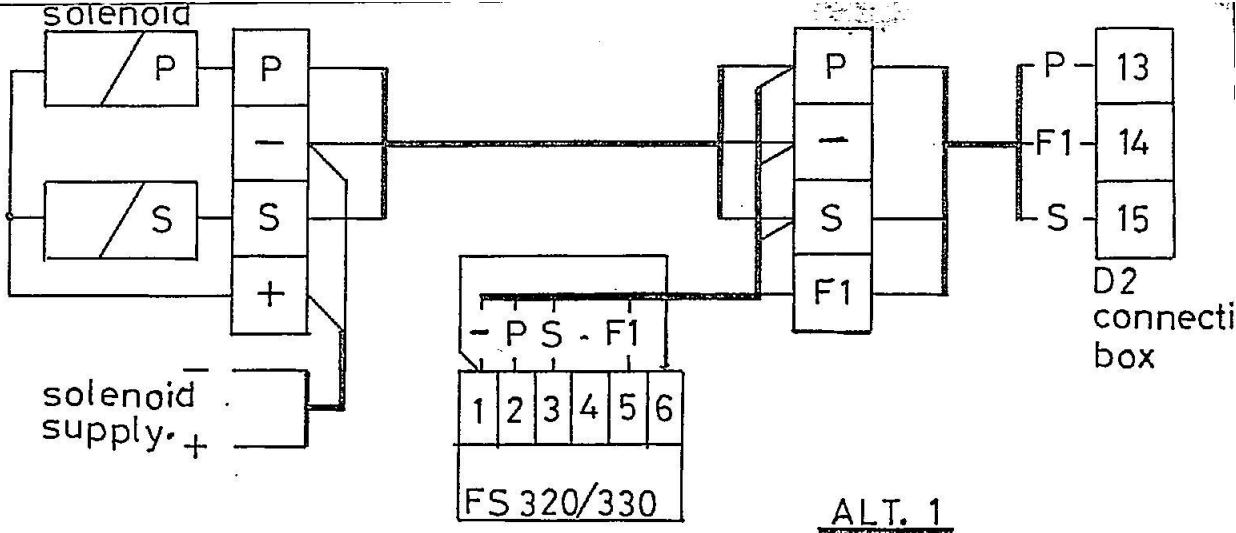
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Kontroll	Stand.kontroll	Godkjent		
CONNECTION DIAGRAM				Erstatning for:
D 2				Erstattet av:
				2011 C
Henvisning:		Beregning:		



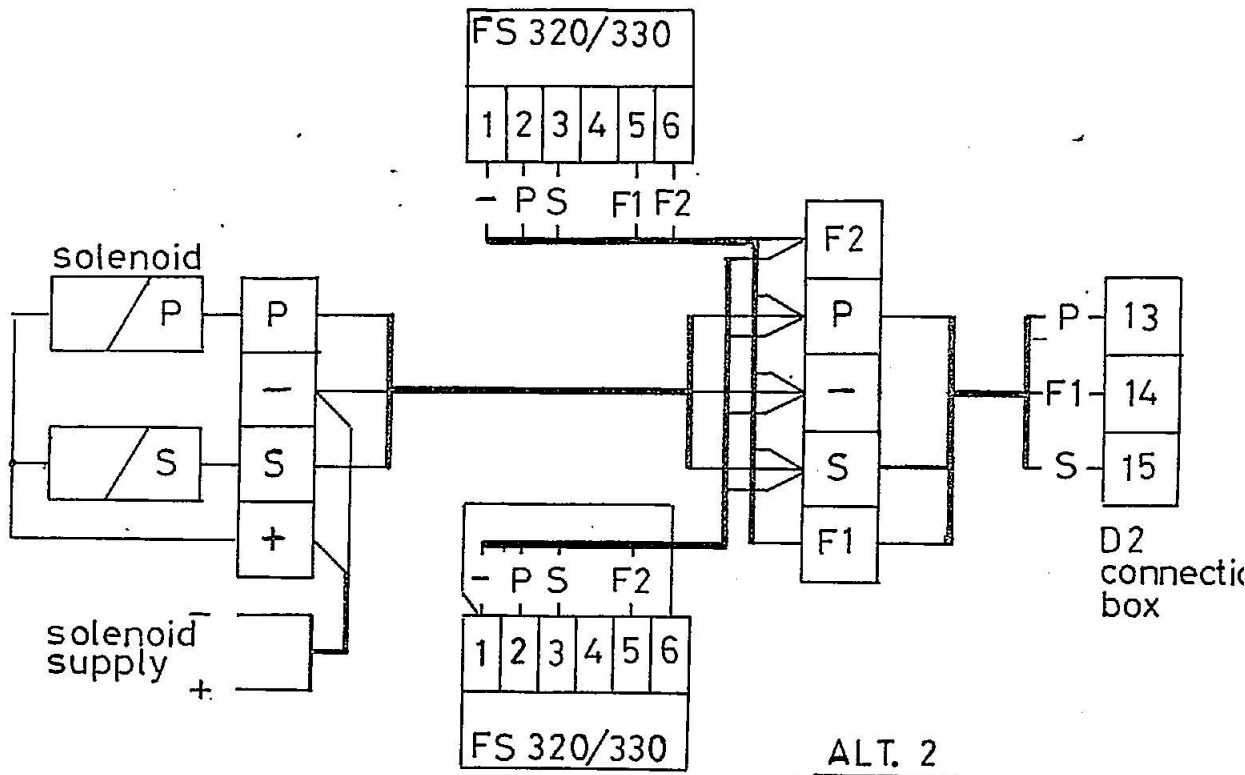
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					DRWG. NO.	20 04F		



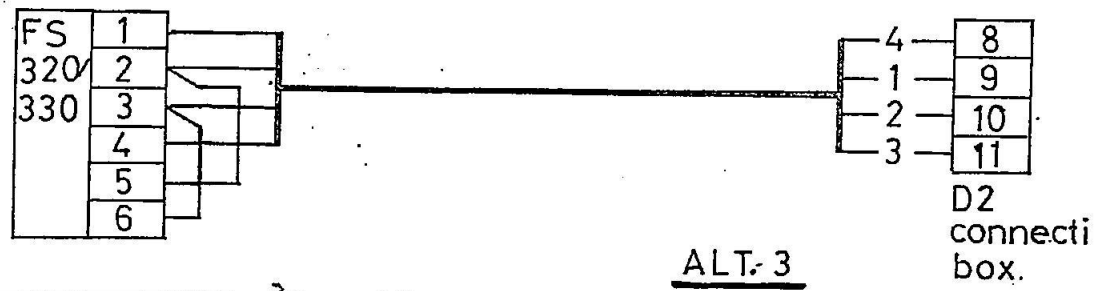
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a/s el-trade								
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Oslo 5								
Norway					DRWG. NO.	2010 J		
			RUDDER TRANSLATOR /					
			RORFØLER					




ALT. 1



ALT. 2

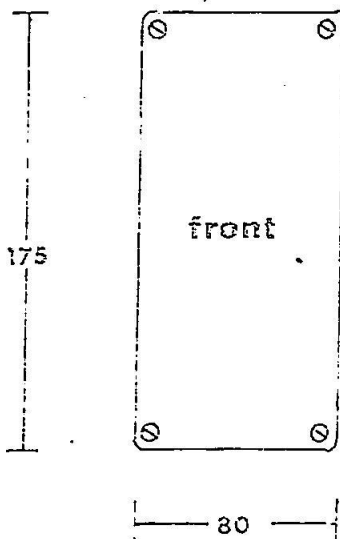
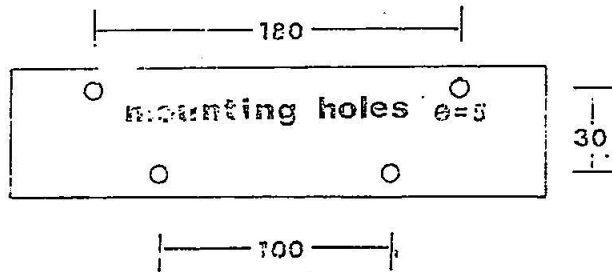
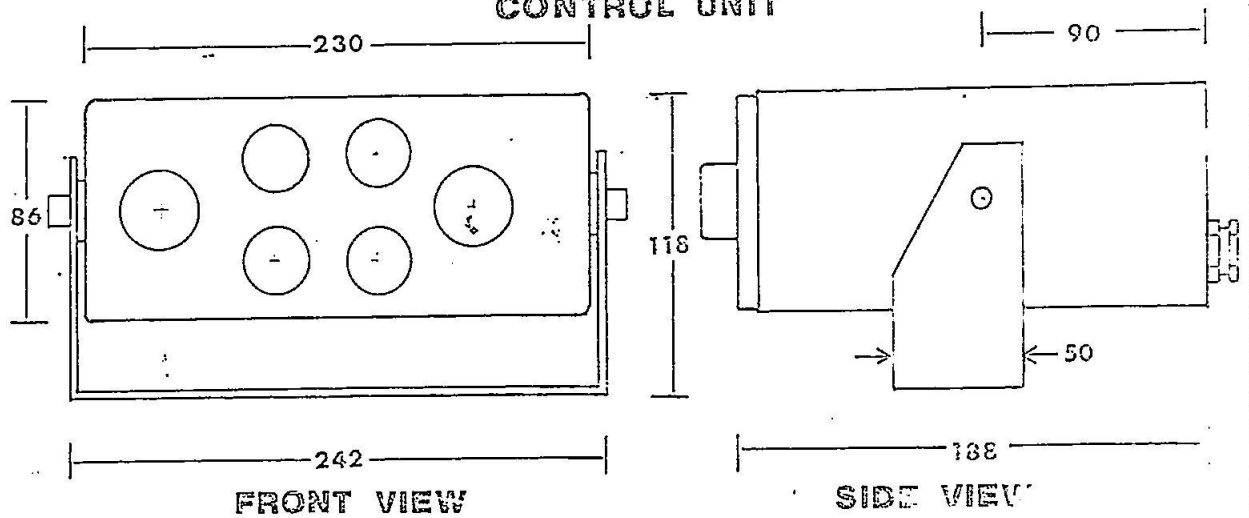


ALT. 3

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Kontroll	Stand.kontroll	Godkjent			
CONNECTION DIAGRAM FS320/330 REMOTECONTROL,				Erstatning for:	Erstattet av:
				2011 F	
Henvisning:		Beregning:			

AUTOPILOT D2
DIMENSJONER

CONTROL UNIT



CONNECTION
BOX

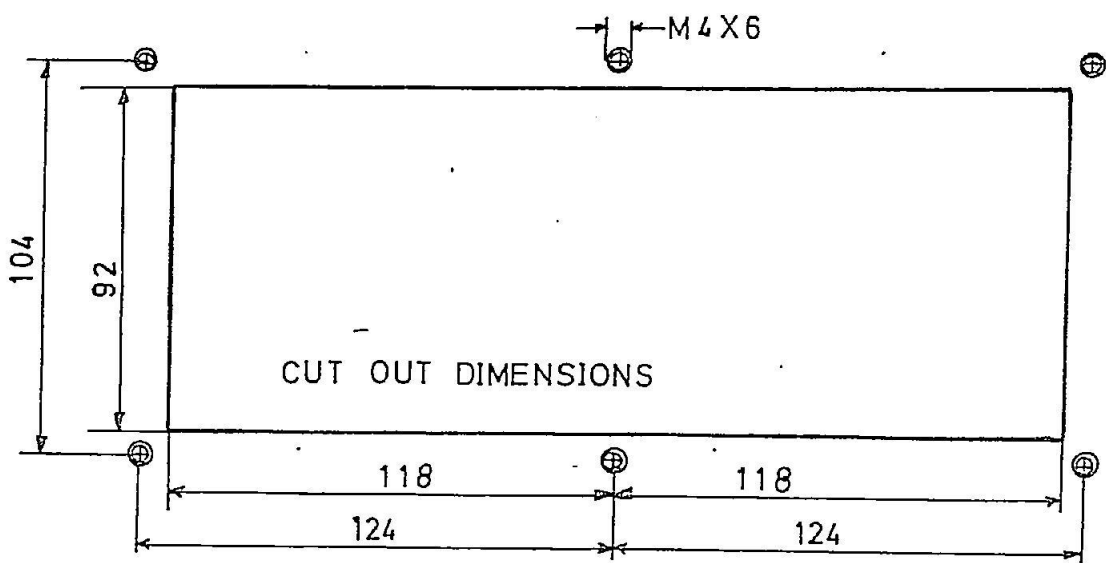
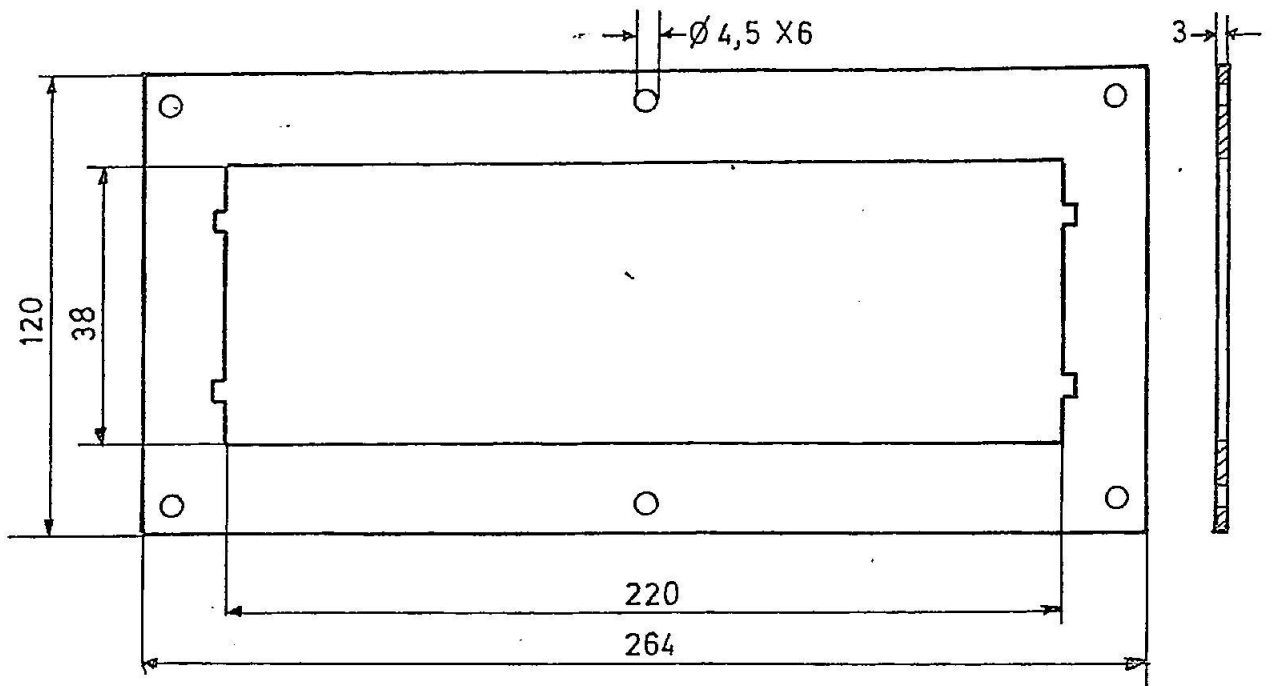
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Electro Automation

TELEFON 39 01 00 - LOK 222

5423 KOLESLINAVEIEN

Norway

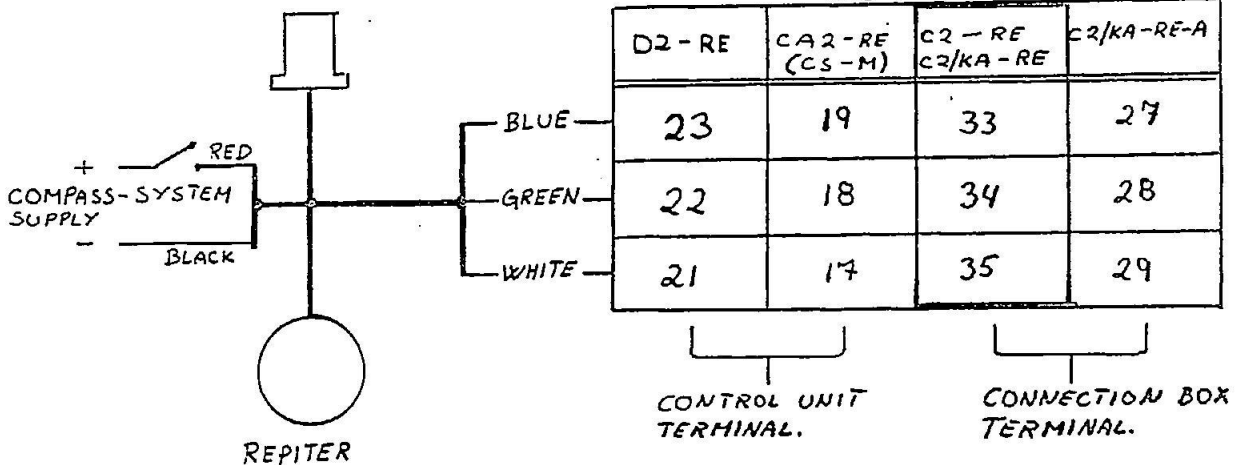


Dato 23-9-80	Konstr./Tegnet A.B.	Tracet	Målestokk 1:2	Erstalling for. Erstallet av. 2011 H
Kontroll	Stand.kontroll	Godkjent		
BRACKET FOR CONSOLE MOUNTING				
Henvisning:		Beregning:		

METEOR Compass only to be connected to RE-vertion of ELTRADE autopilots.

Pilot and alarm to be connected according to wiring diagrams. Compass circuits to be connected as shown on Tab. 1 blow.

METEOR COMPASS.



METEOR Repeater and Sensor to be connected as shown in "Installation Instructions" attached to the system.

The METEOR Systems supplied at the moment all operates on 12 V DC. Please observe that voltage to METEOR System and Auto-pilot is connected according to Fig. 1 - respectively Fig. 2.

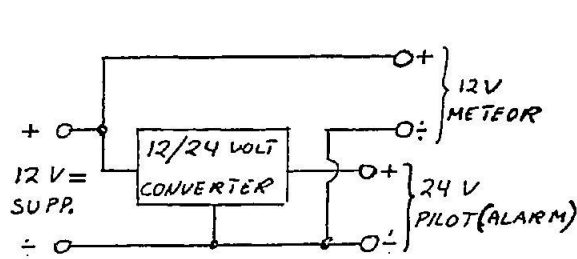


FIG. 1

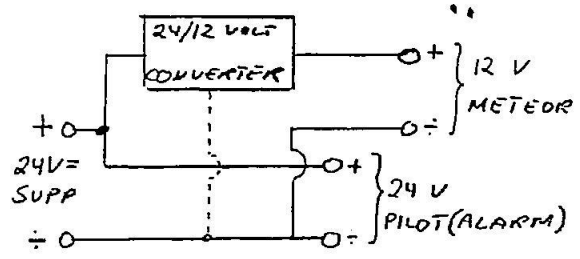
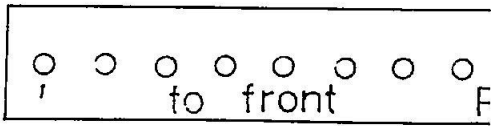
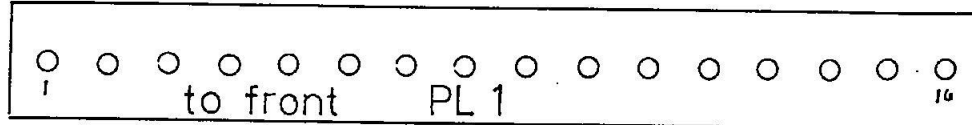
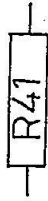
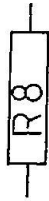
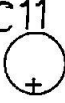
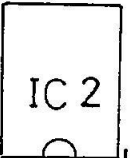
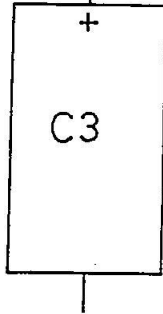
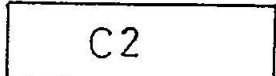
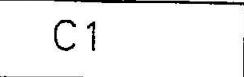
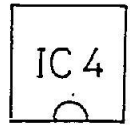
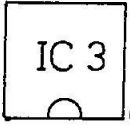
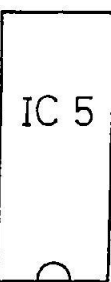
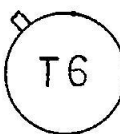
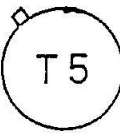
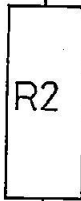
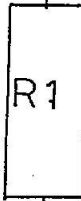
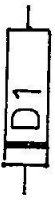
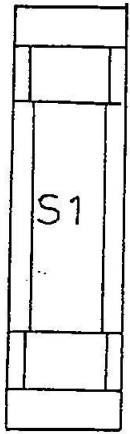
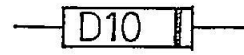
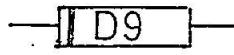
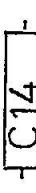
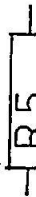
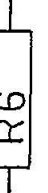
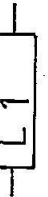
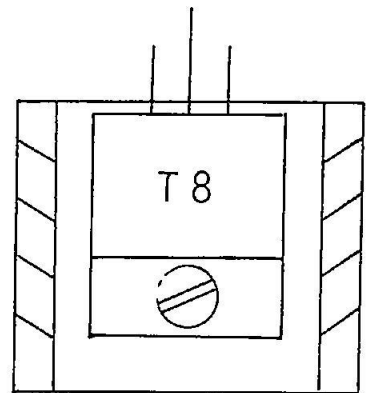
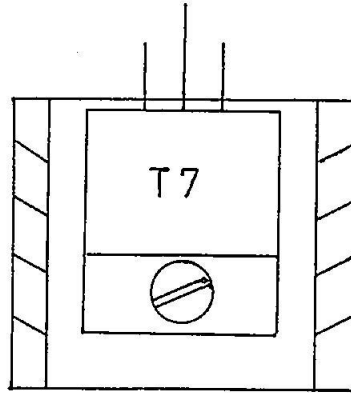
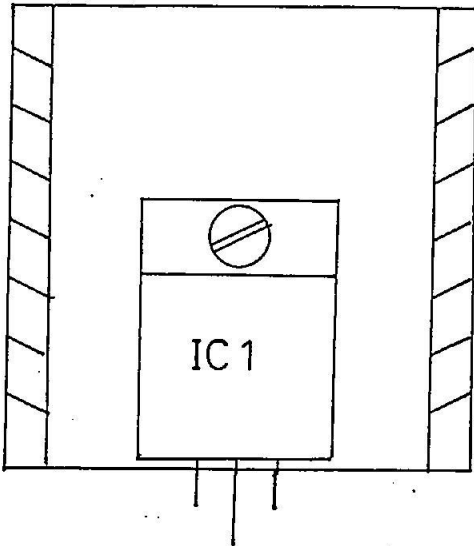
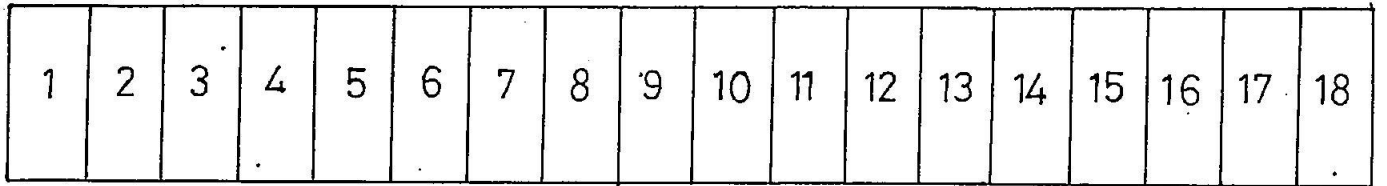
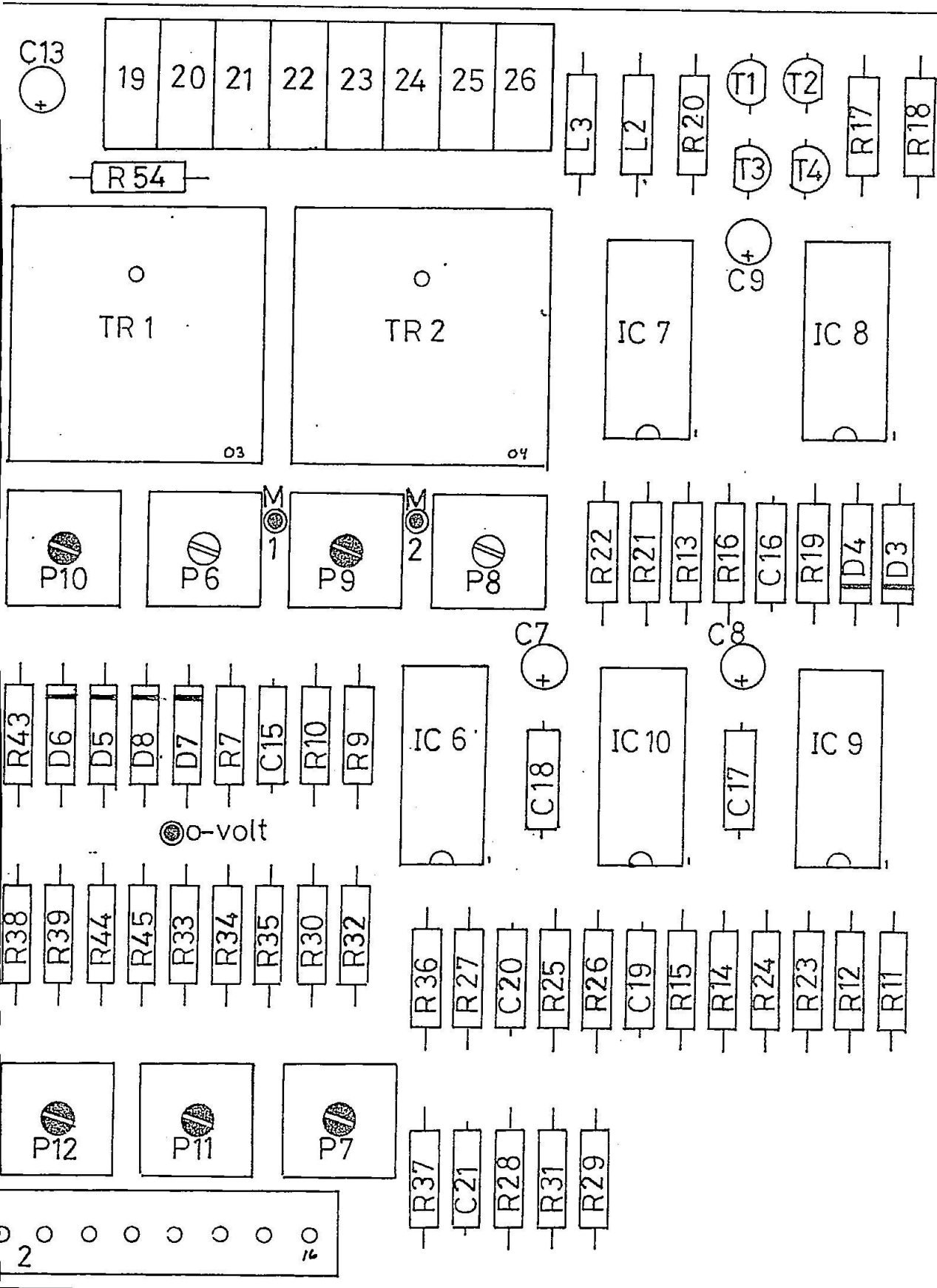


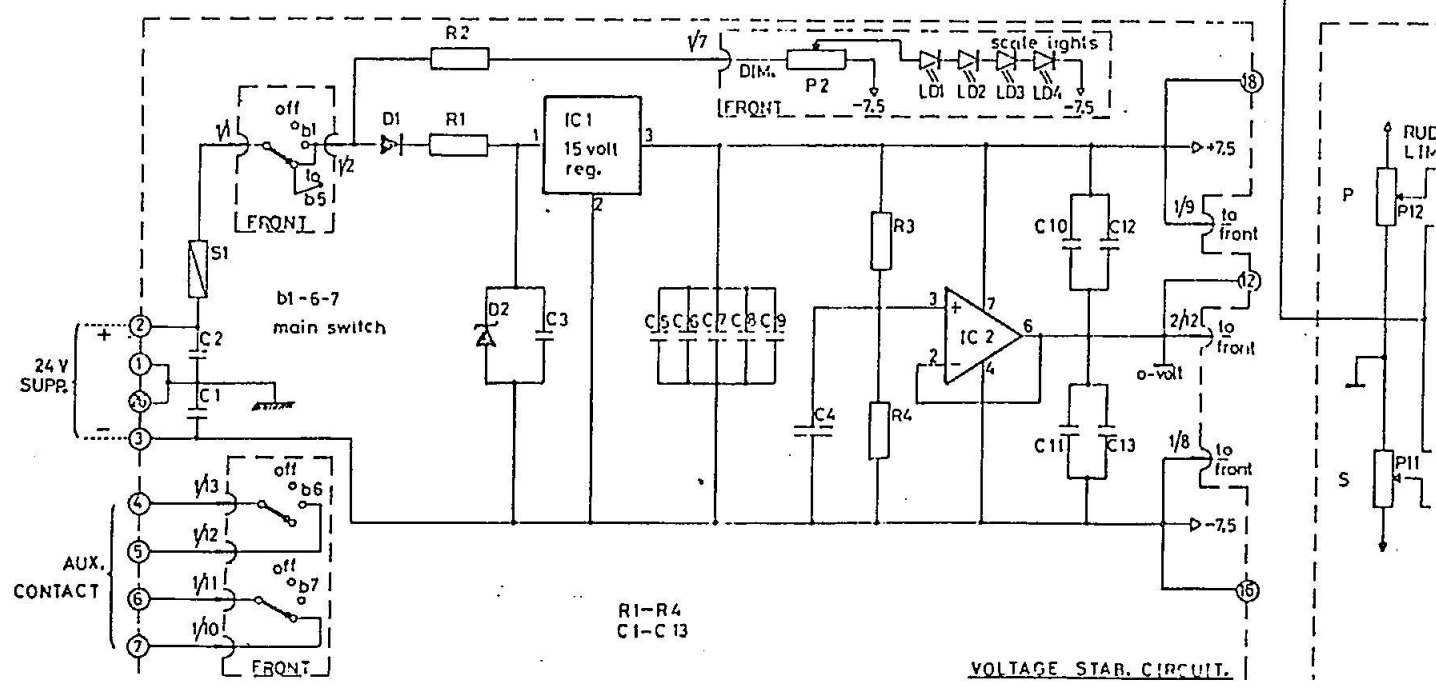
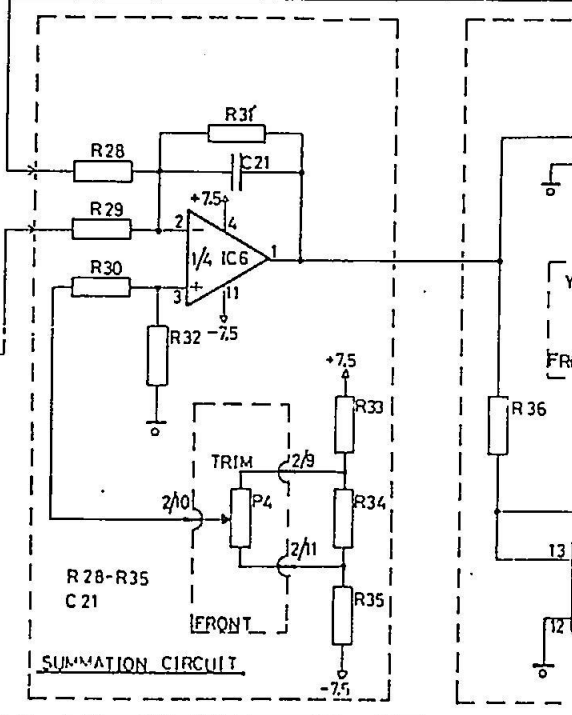
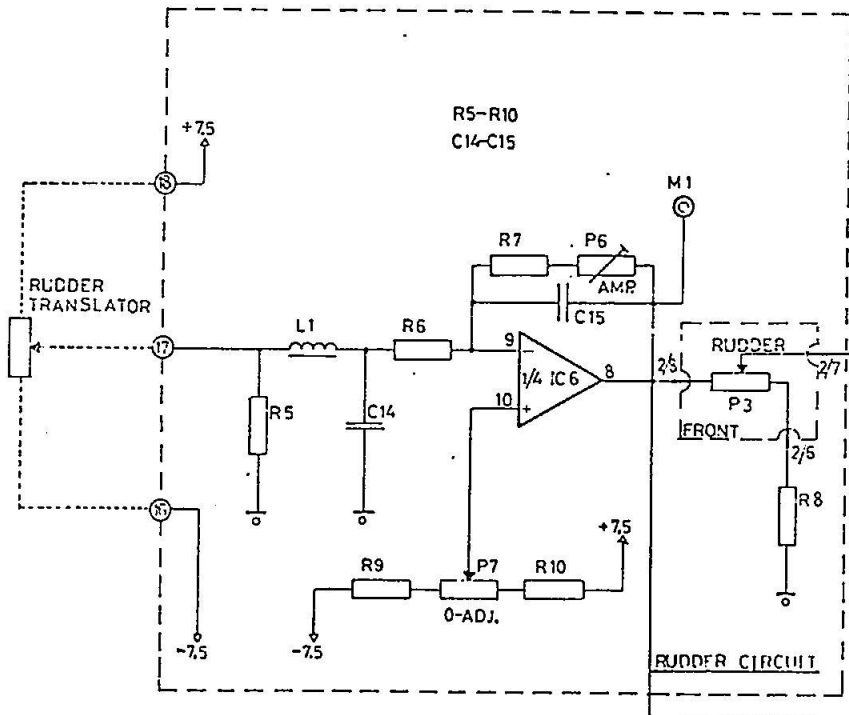
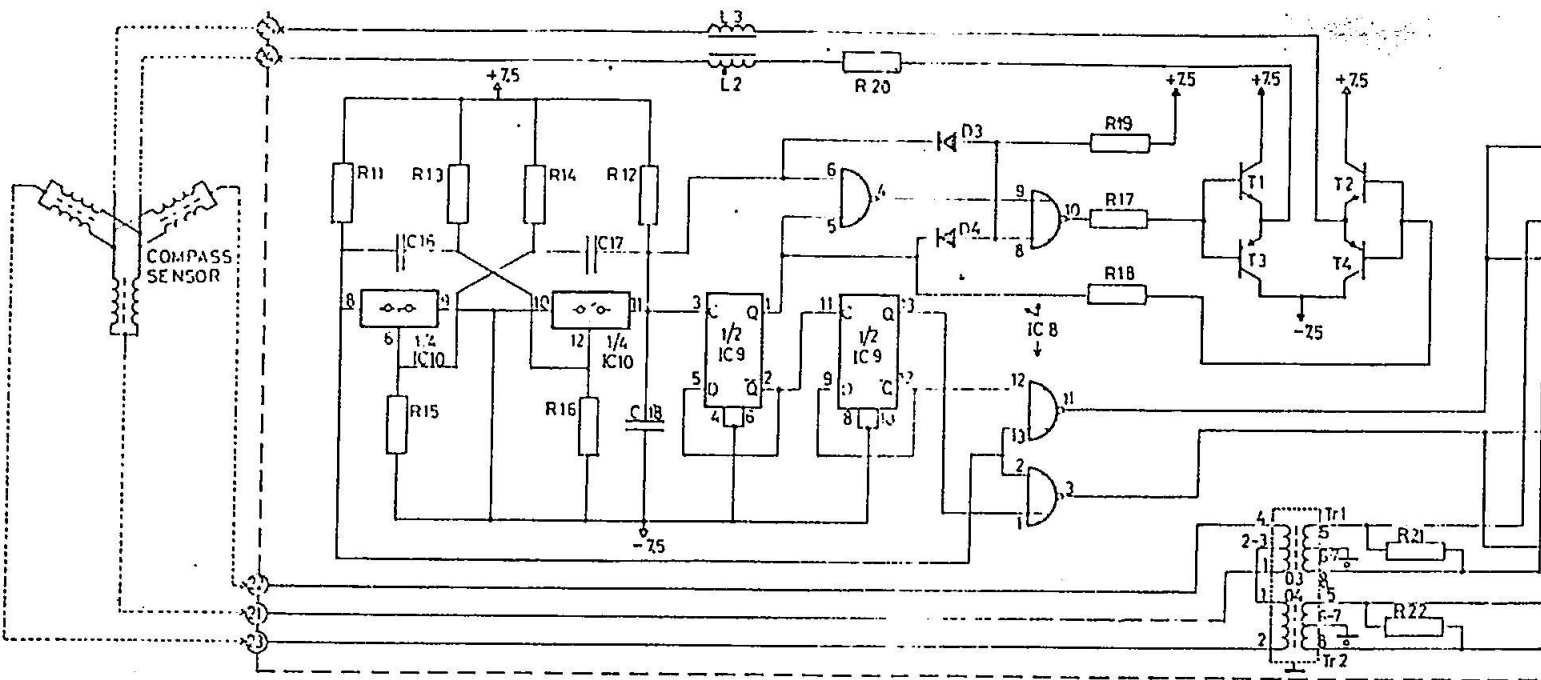
FIG. 2.

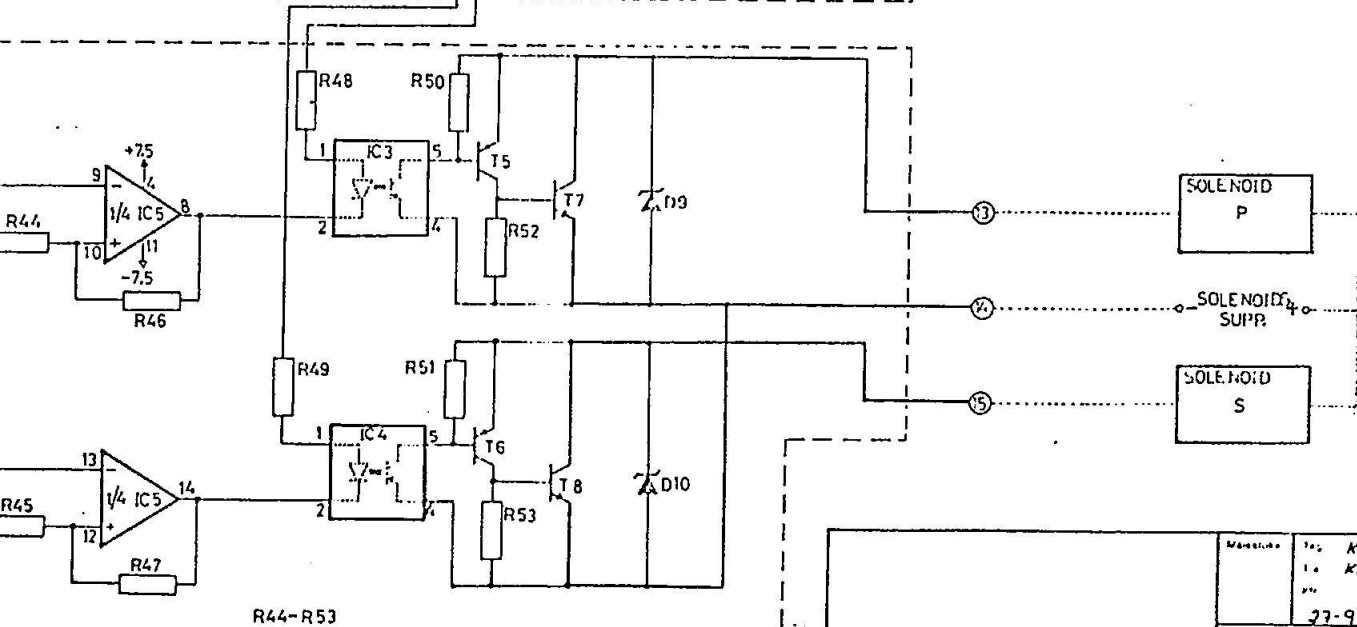
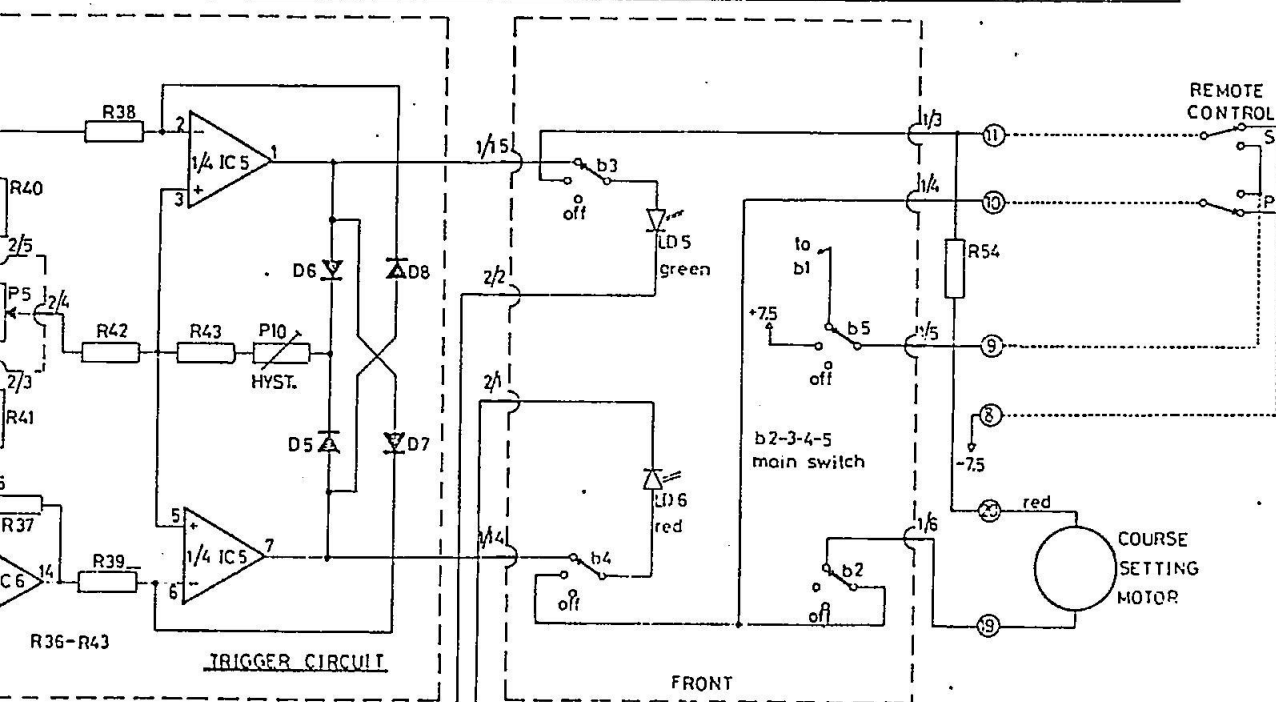
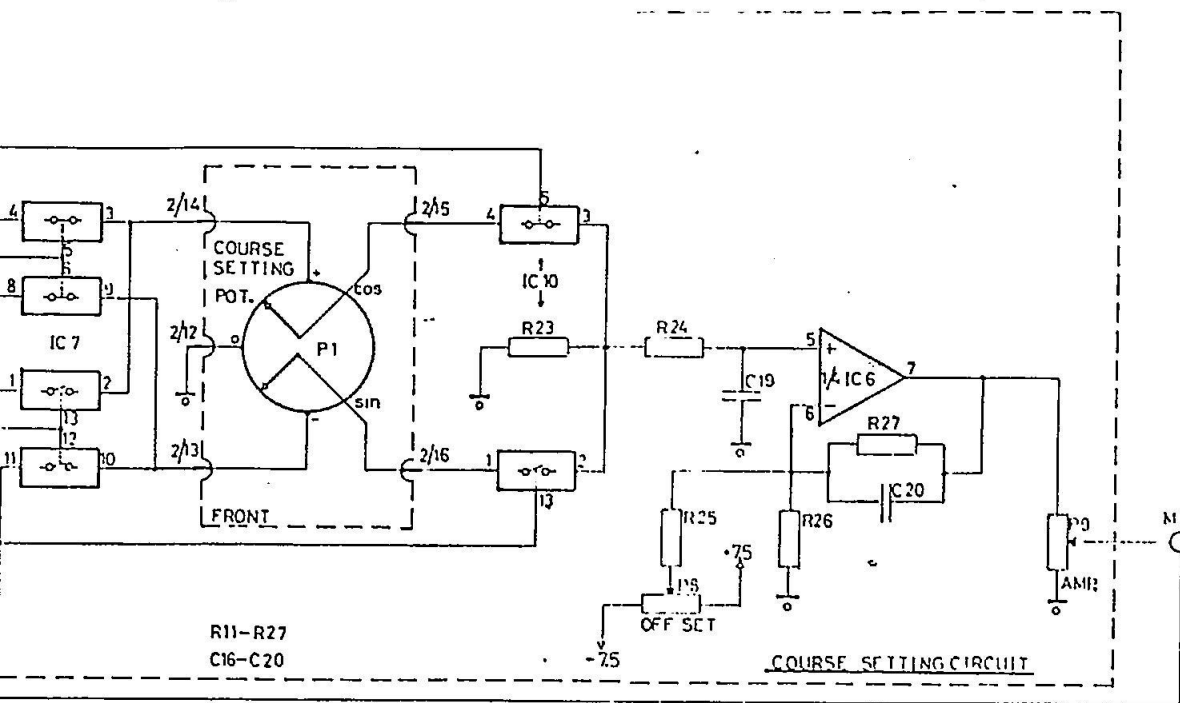
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ITEM no.	QT.	MAKER	TYPE	REMARKS					
Electro Automation TLF 1051 38 01 00 - LOK 222 5493 KOLBEINSVIK Norway				COMPONENTS LAYOUT D2					
				CORR.	CORR.	CORR.	CORR.	CONSTR.	DATE
								X.7.	26-8-80
				DRWG. NO.	2011 B				





EA-PILOT	Manuscript	K.T.
	Drawings	K.T.
		27-9-80
	D2 001	