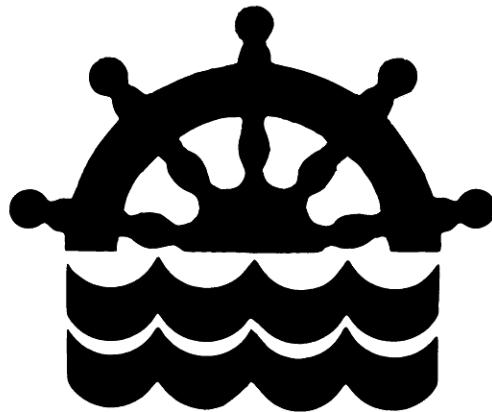


**MS-1
MOTORSTARTER
with MR200 remote**

Operation
and
Installation
manual

V.2.2 February 2003



SCAN-STEERING

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1 Construction

The motorstarter controls and supervises the electric motor (power unit) for the steering gear.

The motorstarter is build up by two circuits: An alarm-circuit and a control-circuit, both electrically separated. The basic circuit is shown in drawing EMS-01-1 (Appendix A).

The control-circuit directly drives a contactor which is used for switching the el-motor (power unit) on and off. The alarm-circuit supervises the el-motor and oil-tank and in case of a failure an alarm is given.

The motorstarter can be connected with one or more remote controls which are identical with the motorstarter except for the emergency stop and the ampere meter.

The motorstarter is equipped with one emergency stop button. If wanted it is possible to connect more emergency stops. Owing of the way the system works it should be notify that:

If any work has to be done near the steering gear, power unit, the emergency stop must be activated (pressed in) and remain in this position until all work has been finished.

The motorstarter has to be supplied with power from the ships main battery (24 Vdc) and from the main supply, 220, 400 or 440 Vac. Beside this an internal battery is connected to the alarm-circuit which supplies the alarm-circuit in cases where the power from the main battery disappears. The capacity of this battery is enough for supplying the alarm-circuit in 10 minutes. This battery enables the motorstarter to give an alarm in case of missing main supply.

2 Failures and alarms.

The motorstarter is capable for generating 3 alarms:

POWER FAIL ALARM (RED): lights when

- a) The AC power (220, 400 or 440 Vac) to the power unit disappears.
- b) There is a error in the phases of the power lines. Either a phase is missing or the phase-sequence is wrong.
- c) There is a error in the supply to the alarm-circuit. Either the power from main battery is missing or below 19V.
- d) The voltage of the internal battery is too low.

LOW OIL ALARM (YELLOW):

Turn on when the oil level in the tank are below minimum.

OVER LOAD ALARM (YELLOW)

Turn on when the power unit consumes more power then recommended. If this fail stays for a longer period the el-motor can be damaged seriously.

None of the alarms stops the power unit but if the power fail is caused by missing AC power the power unit stops.

The circuit is used to detect a power fail has a build-in time delay to prevent errors in cases where the power is off for just a moment.

An alarm is visual in the front panel of the motorstarter. In the remote control MR100 there is both visual and acoustic. The acoustic alarm can be reset by activating the key corresponding to the alarm. However, the alarm will only disappear (the light turns off when the error causing the alarm is repaired and the key is activated again, as an acknowledgement for the repair.

If the fail causing the alarm is repaired or it disappears before the first activation of the key, then the alarm-circuit will be reset by the first push.

2.1 *An example*

Let us give an example of the function in case of a failure for instants Low oil level:

When the sensor in the oil tank reaches a certain level the LOW OIL LEVEL signal goes on. This triggers the circuit which switch on the light in the LOW OIL and also the acoustic alarm.

When the key LOW OIL is pushed the acoustic the acoustic stops but the light in the alarm remains on.

After refilling the oil tank the level sensor deactivate the LOW OIL LEVEL signal but without resetting the alarm. The alarm light LOW OIL will only disappear when the key LOW OIL is pushed a second time. This is the acknowledgement for the “repair” of the error.

3 Other indications

There are 3 lamps indicating the state of the power unit:

POWER ON (BLUE):

Turn on when phase sequence and all supplies are correct.

START (GREEN):

Turn on when the power unit is running.

STOP (RED):

Turn on when the power unit is stopped.

The power unit starts and stops by activating the keys STRART and STOP.

4 Build-in test

The POWER ON indication is used to test the system. Pushing TEST (POWER ON) lights all alarms and indications, sounds the acoustic alarm and forces the alarm-circuit to act as a fail occurred in all 3 sensors (POWER FAIL, LOW OIL and OVER LOAD). The alarms will turn off after releasing the TEST and all the alarm keys have been pushed. Thereby the reset-circuit will also be tested.

5 Installation

The motorstarter is connected according to the diagram (EMS-02-1) in the appendix A. This diagram states the minimum dimensions of the cables used.

The impedance in the cables must under no circumstances exceed 100 ohm.

All cables, except the power-cables to the power units, must be shielded, with the shield connected only to the cabinet containing the motorstarter. The cables may not be connected to the remote control if the remote cabinet is already connected to ground. In cases where the remote is not grounded in any way the cable-shield must be connected to the cabinet of the remote.

Before any power are applied to the motorstarter it has to be controlled that all the relays and transformers are suited for the applied voltages. Also the fuses are controlled to be in accordance with the diagram.

If no extra emergency stops are used there has to be a short circuit between terminal 21 and 22 and another short circuit between terminal. 23 and 24 in the connector. If extra emergency stops are used they have to be of type "Normally closed", witch mean contacts in which a connection is established I normal position.

6 Remote control MR200

The functionality of the remote is only to duplicate the operating panel. Normally this remote is installed at the bridge or in the ECR. From this remote the motorstarter can be controlled exactly as the local front panel except that the motor current can not monitored at the remote.

It is possible to connect two or more remotes to the motorstarter, if they are installed parallel.

7 Function of alarm- and control-circuits

This paragraph describes the function of the two circuits in the motorstarter. The diagram for the motorstarter PCB (EMS-04-1) is shown in appendix C.

7.1 Alarm-circuit

This circuit is build using standard electronic components based on TTL-logic. This requires a 5 Vdc supply which is made by converting the 24 Vdc from the main battery through a voltage regulator (U2).

All the control-logic is programmed into U4. This IC get signals from all sensors and control keys and from these it generates the control signals. The IC functions basically as flip-flops which are triggered when a fail occurs and then reset by the control keys when fail is repaired.

Besides this IC two comparators (both in U3) are used to supervise the power supply from either the main battery or the internal battery. If the voltage of the main battery is below 19 V or the voltage of internal battery is below 8 V a POWER FAIL occurs. In the last case all the indications are switched off because the internal battery has only limited capacity. To permit alarm in cases where the main DC supply is missing a special signal DC SUPPLY ALARM is used. The special diode coupling used at the front panel (print SSE740) and MR200 is used to couple the alarm signal together with the "normal" alarm signal.

To help fault finding there are two light emitting diodes (LED) on the print board. The green LED (marked DC) is on when there is power supply from the main battery. This is also the case when the power is below 19V. The red LED (marked AC) lights when the power to the power unit el-motor is present.

If the power from the main battery is shut off for some known reason the internal battery has to be disconnected to prevent an alarm caused by the missing power supply. Also if the main supply is switched off for a longer period the internal battery must be disconnected to prevent a total discharge.

The light intensity in the remote control can be adjusted by the potentiometer. This does not apply to the alarm lights! This intensity adjustment works by pulse with modulation controlled by U9 through the driver U1 and U5.

To reduce the influence of noise created in the cables from the remote to the motorstarter all input signals are connected through a photo coupler (U6 and U7). This permits larger currents in the signal cables and thereby errors caused by electronic noise are nearly eliminated.

The zenerdiode D6 is used to protect the internal battery for overcharging.

7.2 Control-circuit

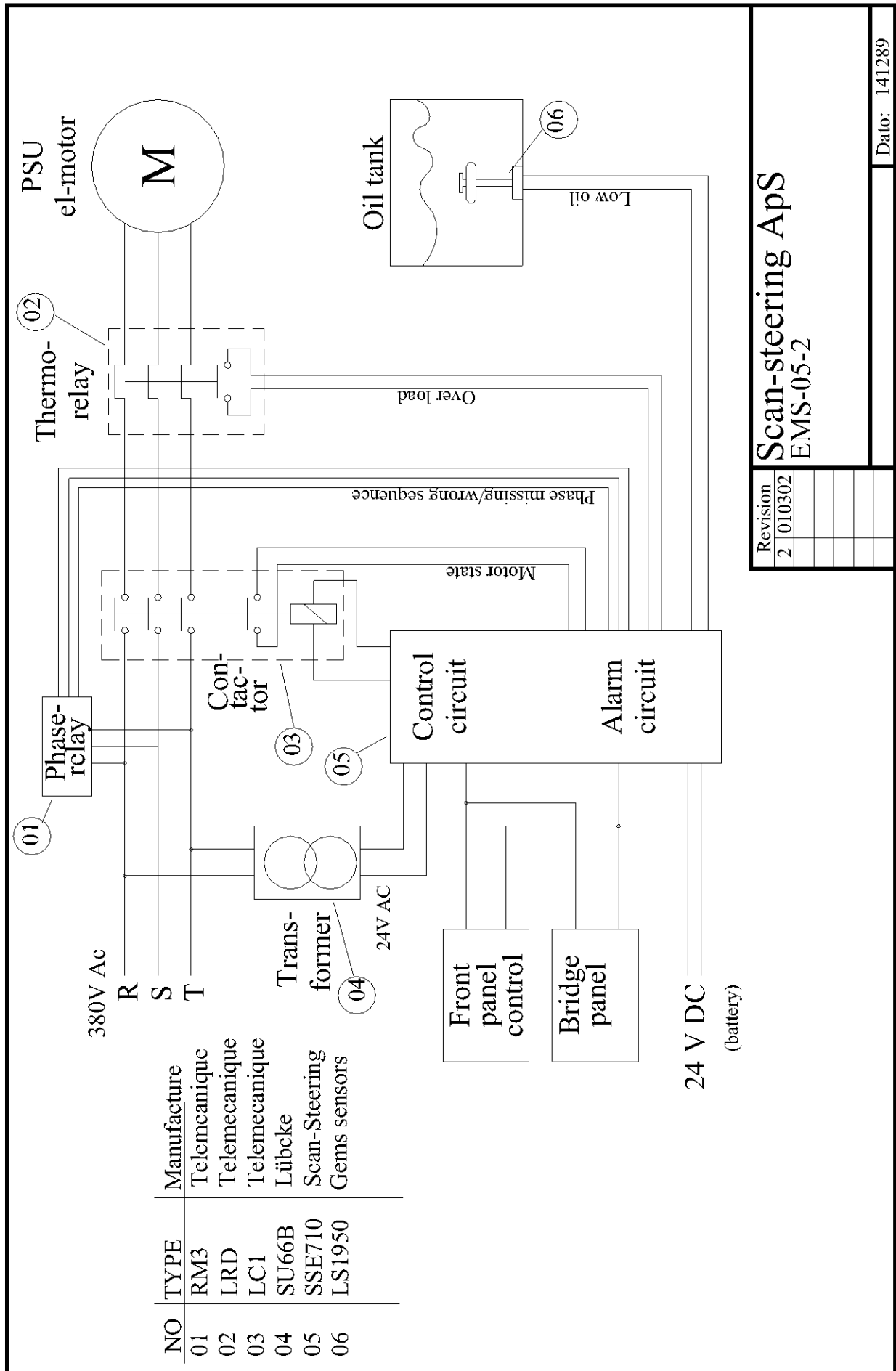
The control-circuit controls the contactor which opens or closes for the supply for the power units. This circuit is supplied from the ships main power (the same power used by the power units). Through a transformer the voltage is converted to 24V which is rectified and filtered.

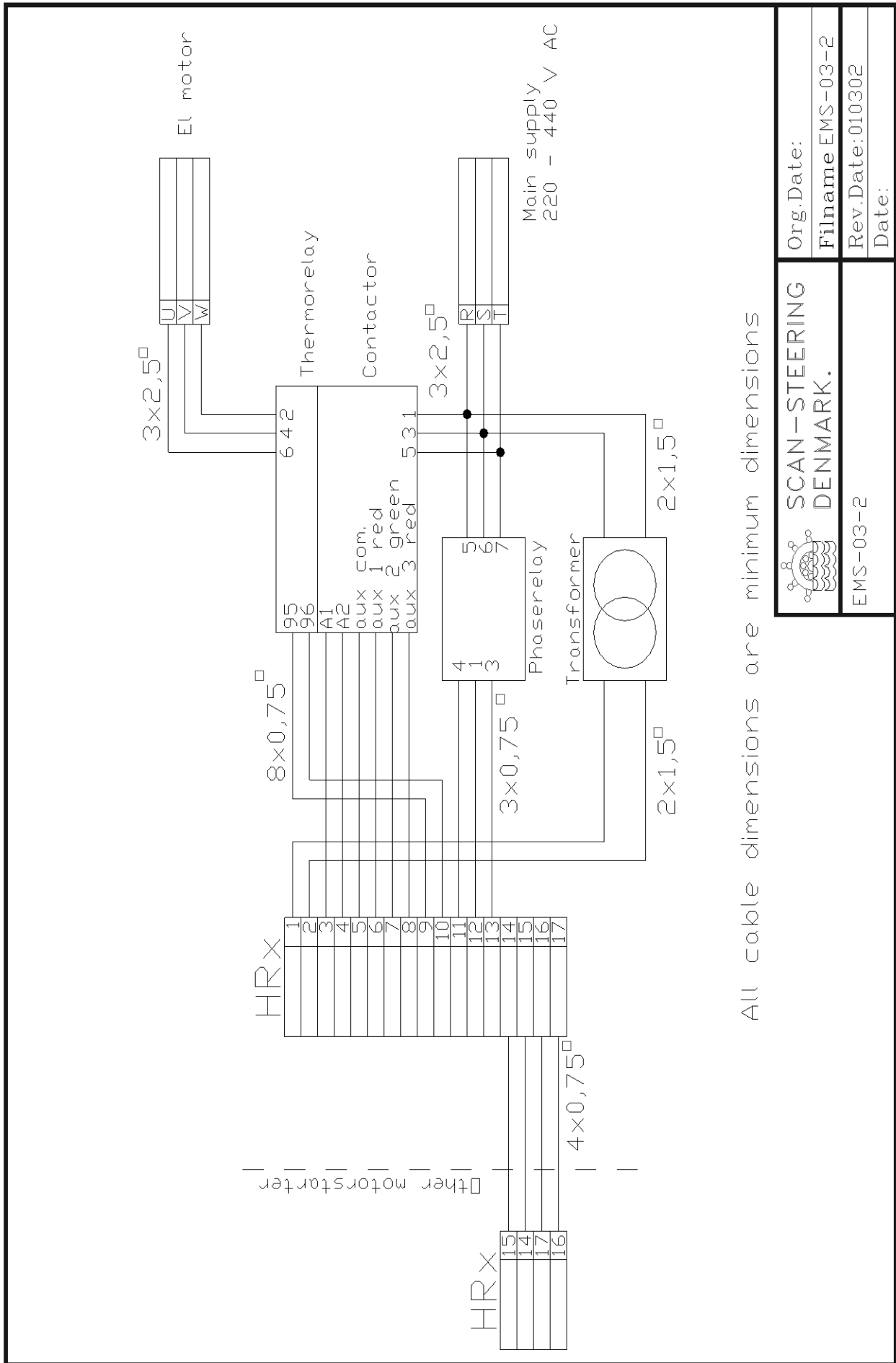
Via a photo coupler and the transistor T1 the contactor is controlled. The transistor is a MOSFET which should be handled with care particularly with respect to static electricity. The coupling of R2, R3 and ISO1 secures that the contactor (and thereby the oil pump) will be activated if the power of the alarm-circuit disappears.

8 Appendix A: Connection diagrams

Contains:

- 1) EMS-05-2, basic circuit
- 2) EMS-03-2, internal connections
- 3) Connections table
- 5) Configuration of potential free alarms





All cable dimensions are minimum dimensions

 SCAN-STEERING DENMARK.	Org.Date:
	FiIname EMS-03-2
EMS-03-2	Rev.Date: 010302
	Date:

Connections from motorstarter back plane (SSE735)

Pin No.	Connection	Pin No.	Connection
1	GND	19	Not Connected
2	DC SUPPLY ALARM ²⁾	20	Not Connected
3	SUMMER ¹⁾	21	Not Connected
4	POWER ON ¹⁾	22	External emergency stop # 1, comm.
5	POWER FAIL ALARM ¹⁾	23	External emergency stop # 1, return
6	OVER LOAD ALARM ¹⁾	24	External emergency stop # 2, comm.
7	TEST ²⁾	25	External emergency stop # 2, return
8	POWER FAIL ACK. ³⁾	26	Auxiliary 24 Vdc output
9	OVER LOAD ACK. ³⁾	27	Auxiliary 0 Vdc output
10	Vb (24 Vdc)	28	24 Vdc MAIN SUPPLY
11	LOW OIL ACK. ³⁾	29	0 Vdc MAIN SUPPLY
12	START ³⁾	30	Not Connected
13	STOP ³⁾	31	Not Connected
14	LOW OIL ALARM ¹⁾	32	Not Connected
15	START INDICATION ¹⁾	33	Oil level sensor 1, common.
16	STOP INDICATION ¹⁾	34	Oil level sensor 1, return
17	DIMMER ⁴⁾	35	Oil level sensor 2, common.
18	Vcc (5 Vdc)	36	Oil level sensor 1, return
RL1	Potential free Stop alarm ⁵⁾	RL1	Potential free Stop alarm ⁵⁾
RL2	Potential free Start alarm ⁵⁾	RL2	Potential free Start alarm ⁵⁾
RL3	Potential free Low oil alarm ⁵⁾	RL3	Potential free Low Oil alarm ⁵⁾
RL4	Potential free Over load alarm ⁵⁾	RL4	Potential free Over load alarm ⁵⁾
RL5	Potential free Power fail alarm ⁵⁾	RL5	Potential free Power fail alarm ⁵⁾
RL6	Potential free Phase fail alarm ⁵⁾	RL6	Potential free Phase fail alarm ⁵⁾

Table A.1. Connections of KL to external devices and remote control.

- 1) Output signal (0 Vdc if activate)
- 2) Output signal (24 Vdc if activate)
- 3) Input signal (24 Vdc to activated)
- 4) Input signal (analog 0-24 Vdc)
- 5) Alarm outputs with Potential free contacts, can be change from NO to NC buy JP1-6 (see page 13)

Pin No.	Connection	Pin No.	Connection
1	} Internal emergency stop # 1, common	14	LOW OIL ALARM ¹⁾
2		15	OVER LOAD ACK. ³⁾
3		16	OVER LAOD ALARM ¹⁾
4		17	POWER ON ¹⁾
5	} Internal emergency stop # 1, return	18	TEST ³⁾
6		19	POWER FAIL ALARM ¹⁾
7		20	POWER FAIL ACK. ³⁾
8		21	DC SUPPLY ALARM ²⁾
9	STOP ³⁾	22	Not Connected
10	STOP INDICATION ¹⁾	23	Vb (24 Vdc)
11	START ³⁾	24	Vb (24 Vdc)
12	START INDICATION ¹⁾	25	Internal emergency stop # 2, common
13	LOW OIL ACK. ³⁾	26	Internal emergency stop # 2, return

Table A.2. Connections of plug ST to front panel.

- 1) Output signal (0 Vdc if activate)
- 2) Output signal (24 Vdc if activate)
- 3) Input signal (24 Vdc to activated)

Pin No.	Connection	Pin No.	Connection
1	24 Vac (TR1)	10	Thermo relay (F1) pin 96
2	0 Vac (TR1)	11	Phase relay (R1) pin 12
3	Contactora (K1) pin A2	12	Phase relay (R1) pin 11
4	Contactora (K1) pin A1	13	Phase relay (R1) pin 14
5	Contactora (K1) pin 13, 51 and 61	14	} Only used for double motor starter. See project wire diagram for connection.
6	Contactora (K1) pin 52	15	
7	Contactora (K1) pin 14	16	
8	Contactora (K1) pin 62	17	
9	Thermo relay (F1) pin 95		

Table A.3. Internal connections, HR1 / HR2

Configuration of potential free alarms

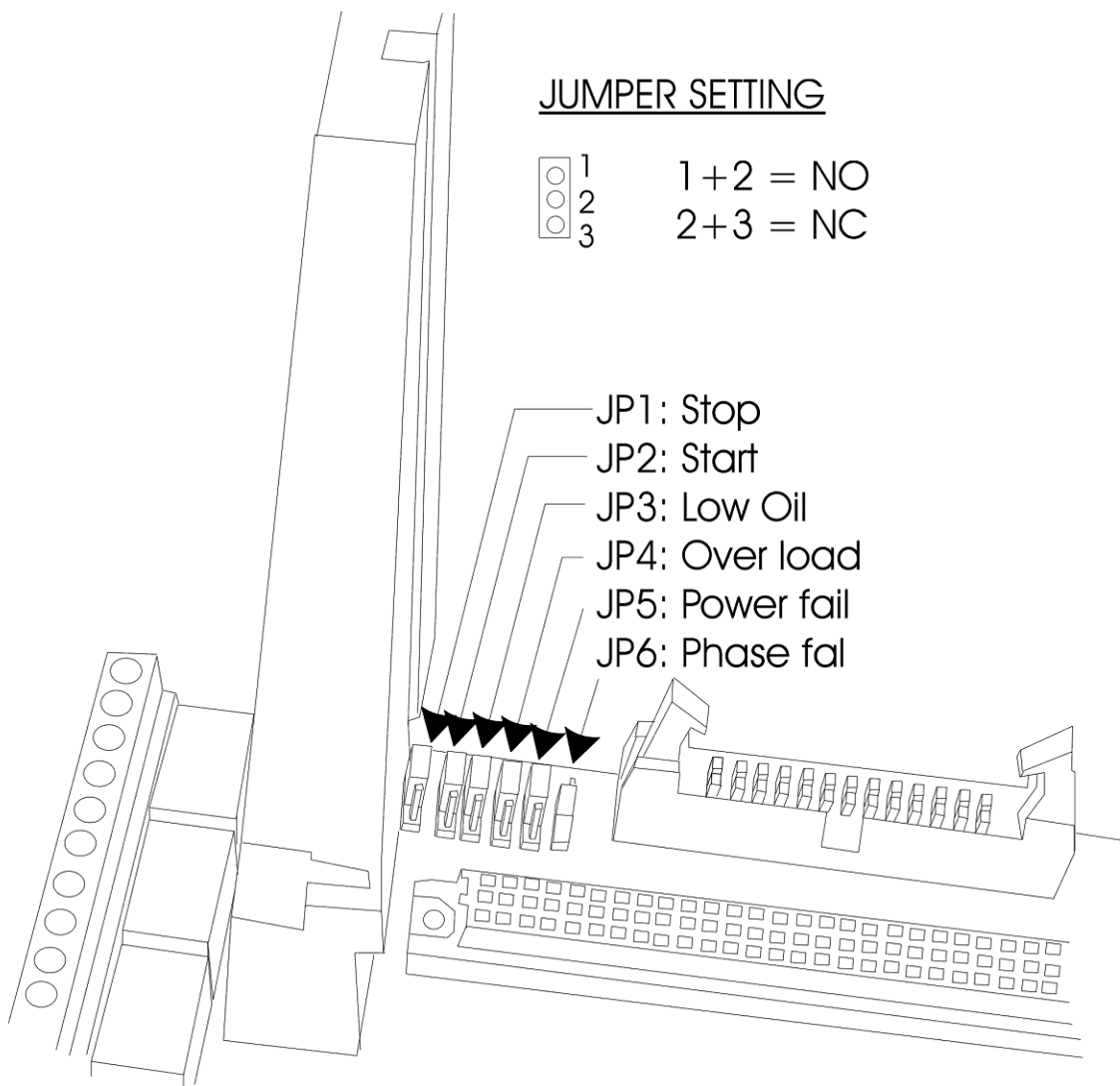


Figure A.1 Configuration of jumpers for potential free alarms

9 Appendix B: Part list for motorstarter

- 1) SSE 710
- 2) SSE 735
- 3) SSE 740
- 4) Box components

5) SSE 710

Numbers	Type	Place
3	1N4005	D3, D4, D5
3	1N4148	D7, D10, D11
1	8,2V zener	D6
1	36V zener	D2
1	68R	R22
2	220R	R7, R15
11	1k	R5, R6, R8, R9, R10, R12, R13, R17, R24, R 29, R31
1	1k5	R21
2	3k3	R2, R3
1	4k7	R1
1	6k8	R28
1	10k	R4
1	22k	R30
1	100k	R27
1	330k	R11
7	1k / 0.5W	R16, R18, R19, R20, R23, R25, R26
1	8x220R	R14
9	100 nF	C3, C4, C5, C6, C7, C12, C13, C14, C26
3	IC socket 14 pin	U3, U8, U9
4	IC socket 16 pin	U1, U5, U6, U7
1	IC socket 24 pin	U4
1	PC817	IS01
1	BC547	T3
1	BC557	T2
1	BC635	T4
2	10uF / 25V tantal	C2, C11
13	10uF / 50V	C8, C9, C15, C16, C17, C18, C19 C20, C21, C22, C23, C24, C25
2	1000uF / 40V	C1, C10
1	LED Red	D8
1	LED Green	D9
1	100k trim. Multi - top ajust.	P1

1	CM64acR, 64 pin m.,90 ^o	J1
1	Fuse socket 5x20	S1
1	3,15A fuse 5x20	S1
1	LM7805	U2
1	IRF530	T1
1	B250 C3700/2200.	D1
2	ULN2003	U1, U5
1	PEEL22CV10	U4, (With software)
1	LM 339	U3
1	NE556, if used with MR100	U9
	Or Plug if used with RC/MS	
1	74HC08	U8
2	PC847	U6, U7
1	Battery socket	BT1

SSE735

Numbers	Type	Place
8	MKKDS3/S, terminals	KL
1	MKDS3/2, terminals	HR1 or HR 2
5	MKDS3/3, terminals	HR1 or HR 2
2	PCB holders, 5501.6	
1	DIN 41 612, connector 64 pin.	SD
1	Cable connector, 26 pin	ST
6	HRS1H-S, Relay	RL1, RL2, RL3, RL4, RL5, RL6
6	Jumper 2 mod.	JP1, JP2, JP3, JP4, JP5, JP6

SSE740

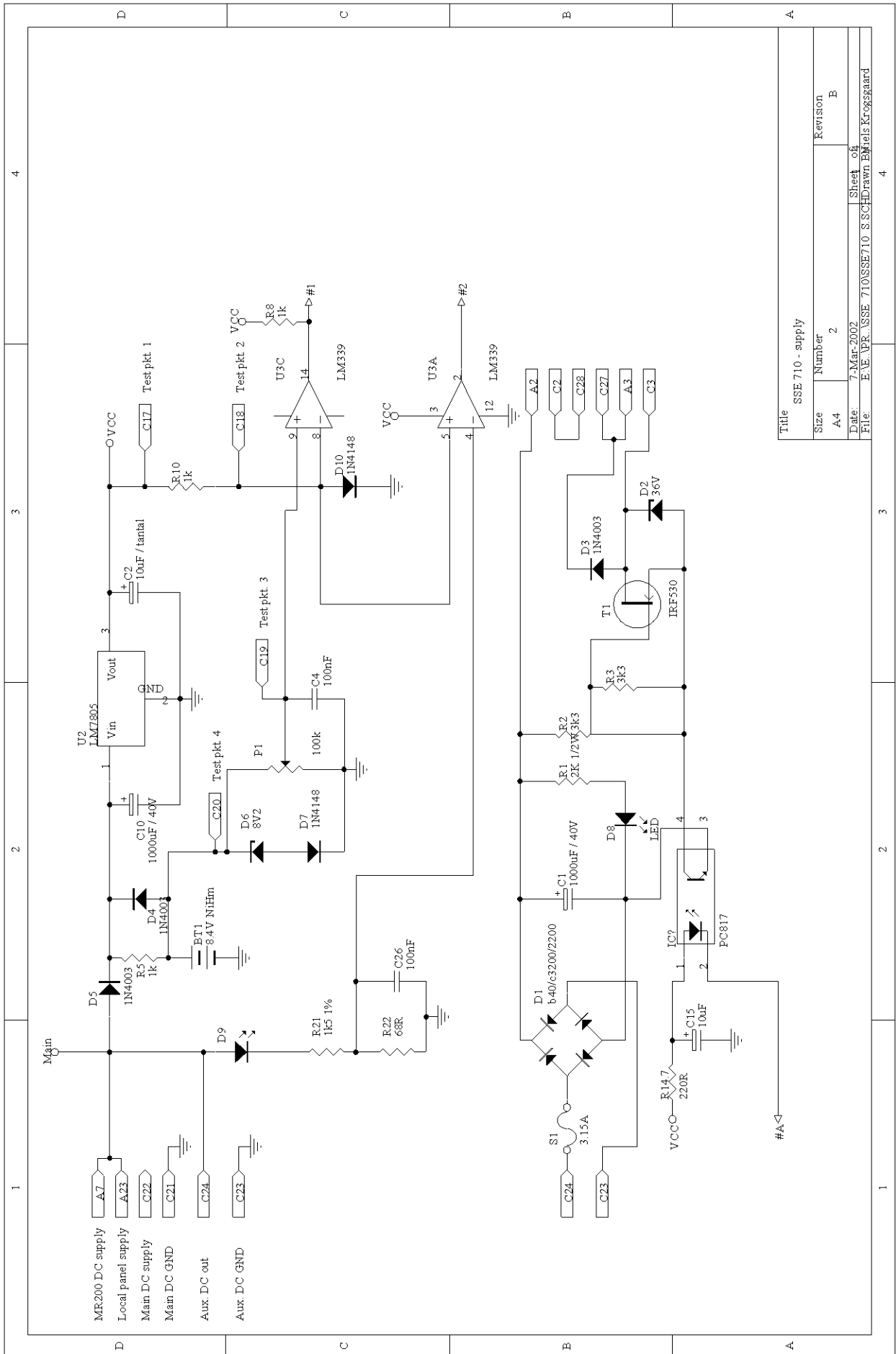
Numbers	Type	Place
6	Swisstac complete	SW1, SW2, SW3, SW4, SW5, SW6
1	Cable connector, 26 pin	ST
1	220R	R1
1	1 k	R2
1	1N4148	D1
1	AA119	D2

Box components

Numbers	Type	Place
1	ZB4 Emergency stop	S1
1	Contact block for Emergency stop	S1
1	Text ring for Emergency stop	S1
1	LC1 DxxBL Contactor	K1
1	LADN02 Contact block for contactor	K1
1	LRD-xx Thermo relay	F1
1	RM4TG20 Phase relay	R1
1	SU66A-38024 transformer	TR1
1	EQ72-X, 0-xxA Amperemeter	I1
1	wago282-107, terminal	X1
6	Wago282-101, terminal	X1
2	Wago249-116, Stops	X1
1	Wago282-322, safety cover	X1
7	PG 16	

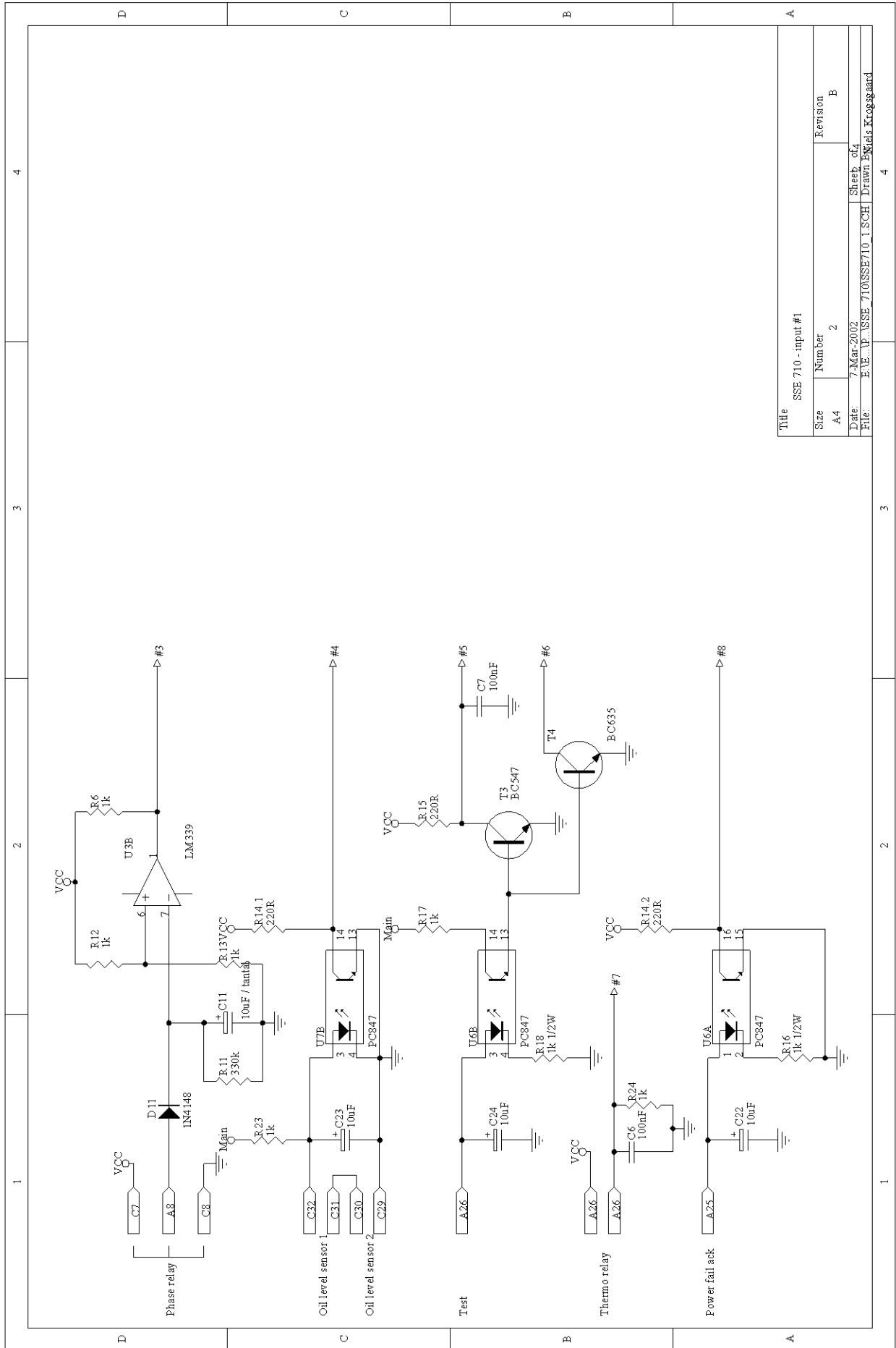
10 Appendix C: Diagram for motorstarter

- 1) Diagram for Sse 710
- 6) Component overview for Sse 710



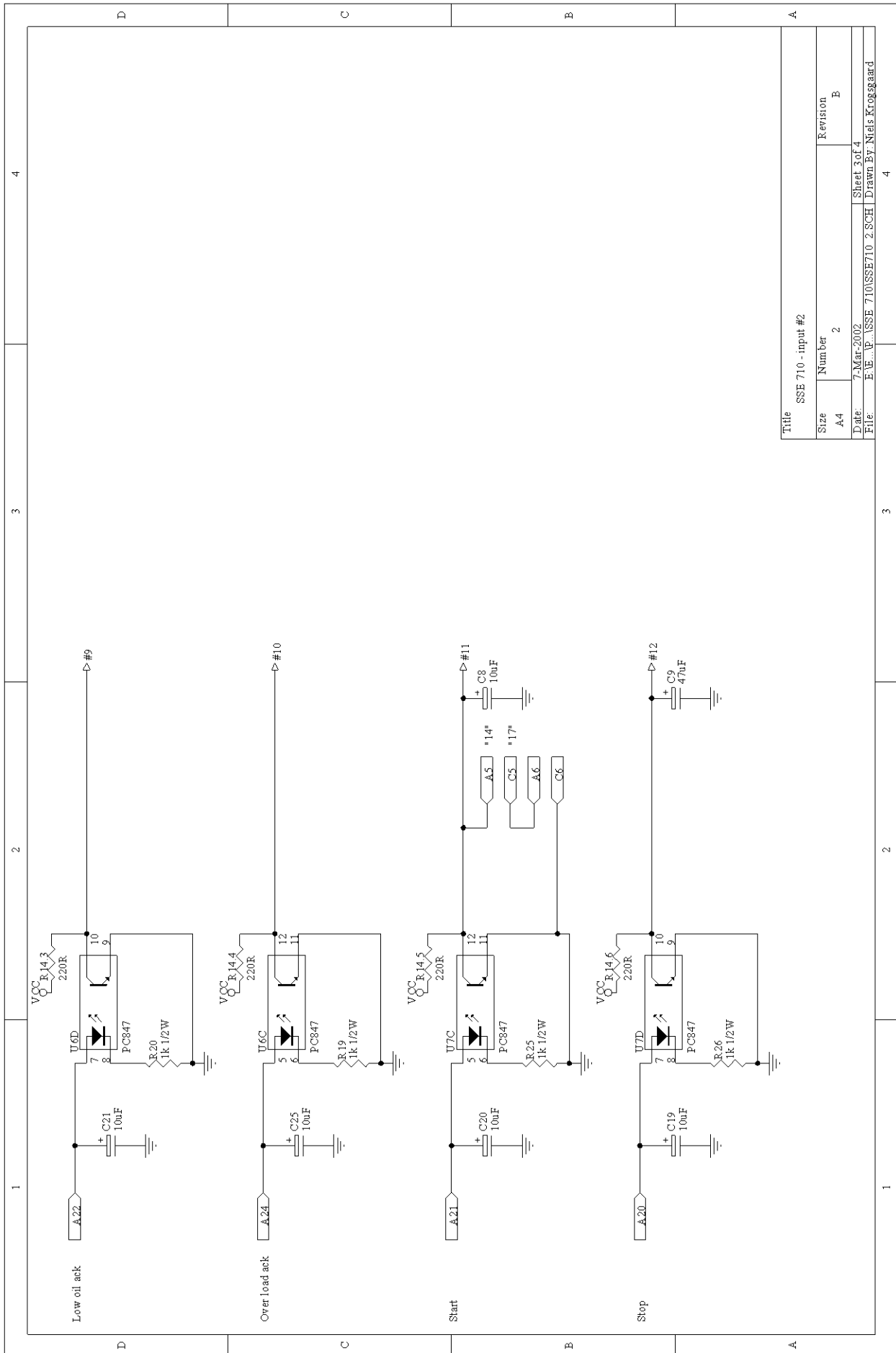
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Appendix C-1



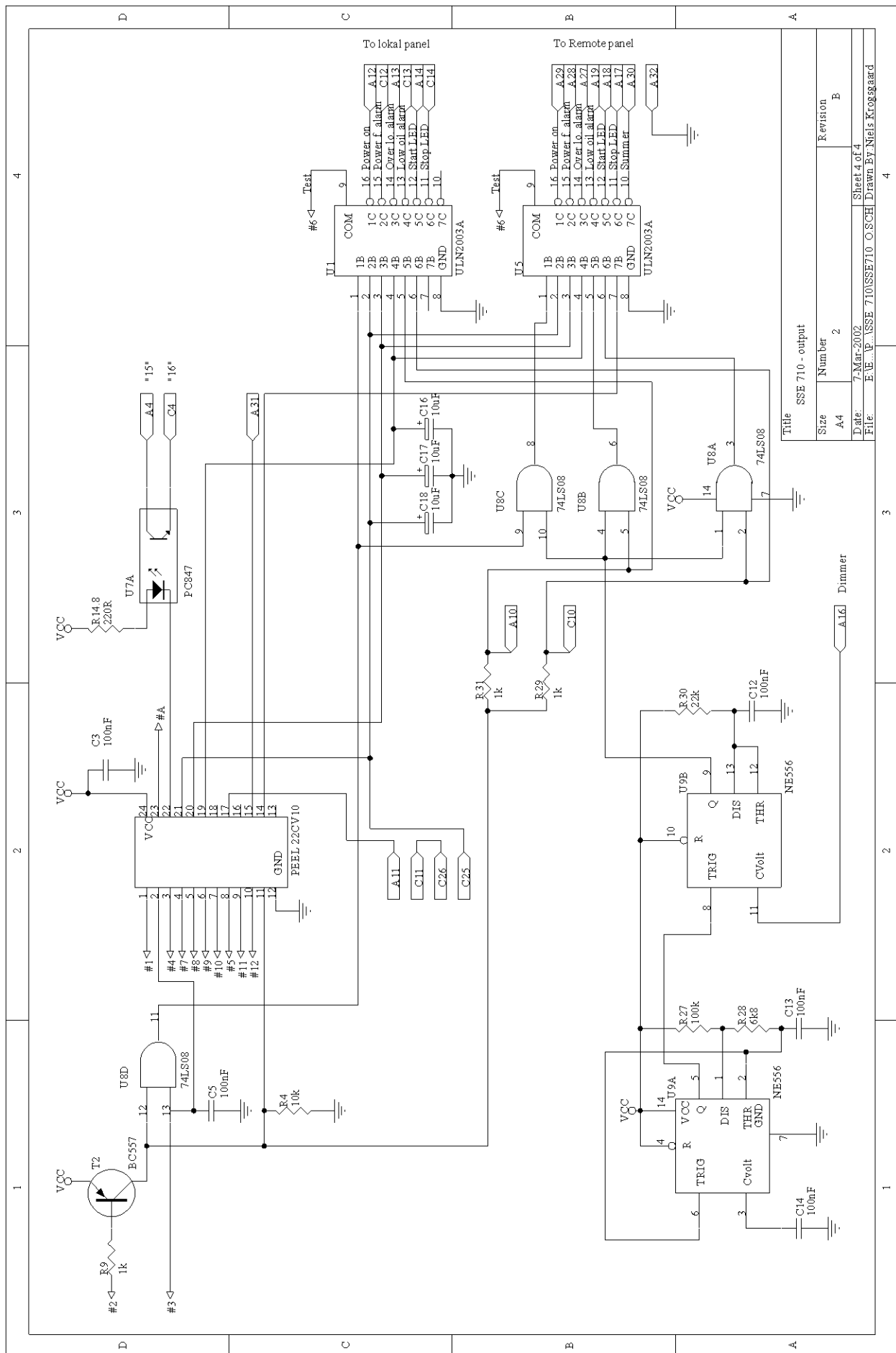
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Appendix C-2



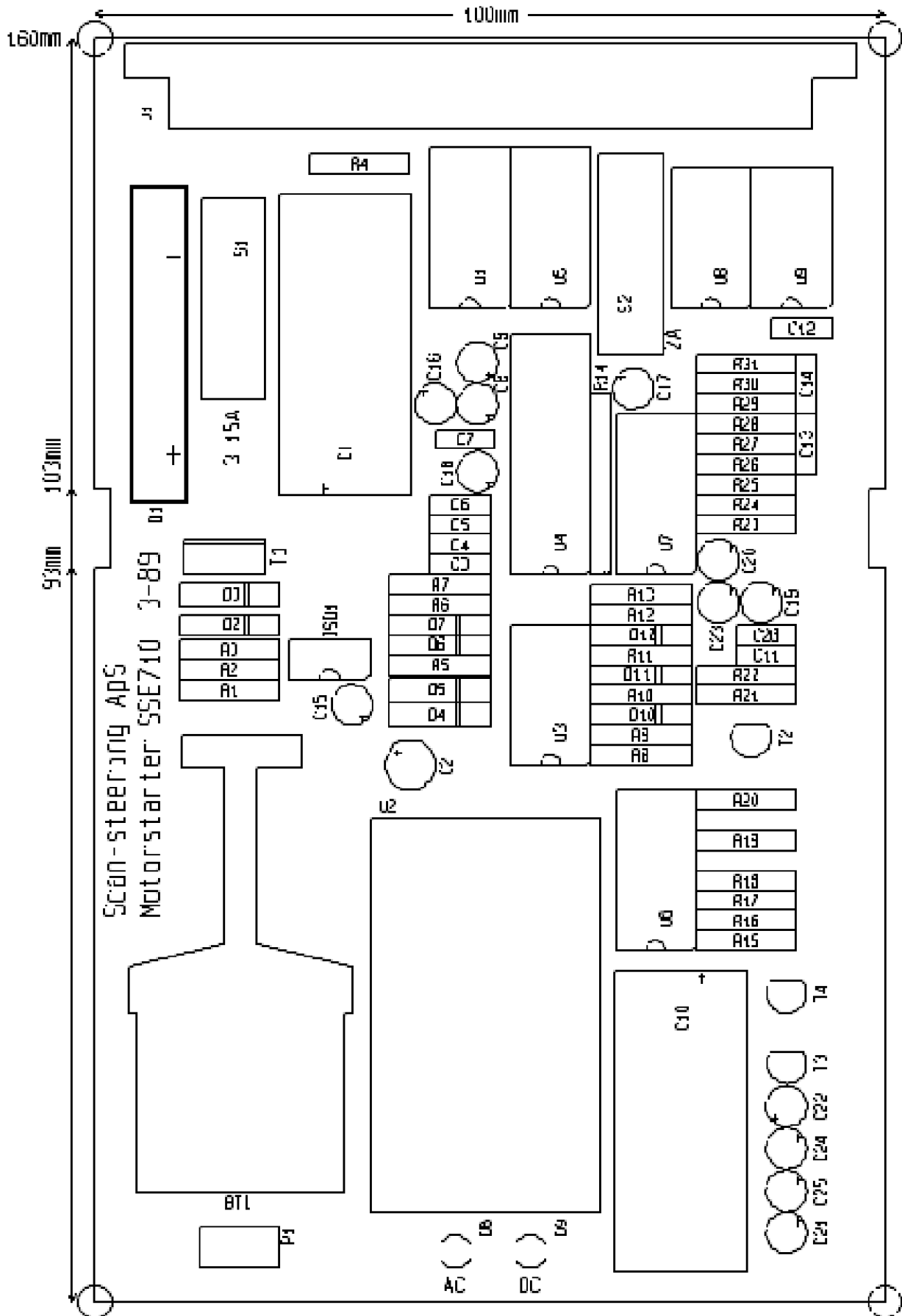
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Appendix C-3



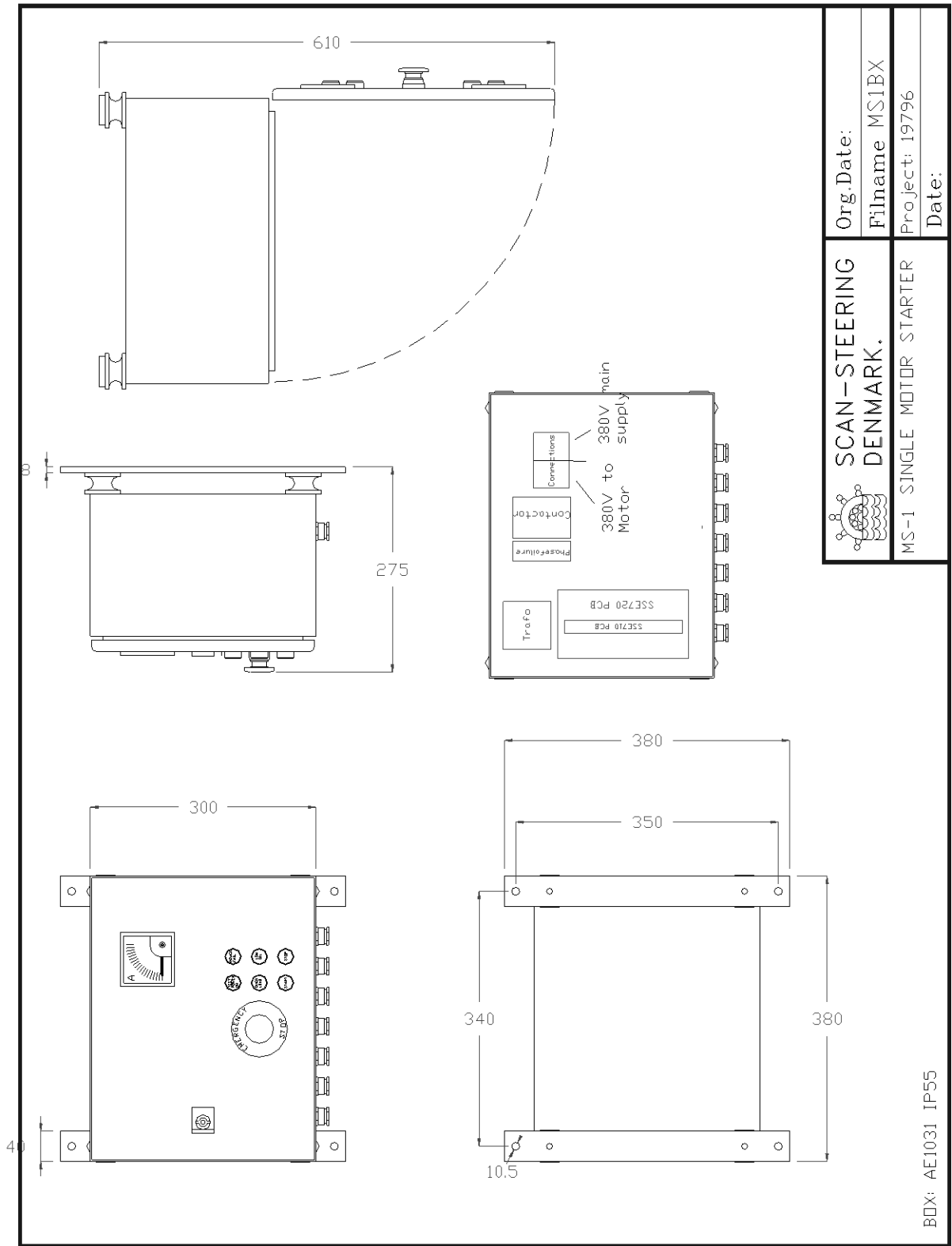
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
Appendix C-4



11 Appendix D: Measures

- 1) Motorstarter



	Org.Date:
	Filname MSIBX
	Project: 19796
Date:	
MS-1 SINGLE MOTOR STARTER	

BOX: AE1031 IP55