6.2. Thyristor module DASD 001, 002, 003

The DASD 00x and the DARA 100x modules shall be pre-assembled prior to mounting into a panel.

- The left side of the DARA 100x shall be unscrewed and removed. You will get 4 screws to left over.
- Remove the "lip" marked with "3" in Section **Routing of cables to DARA 1000/1001/1010**
- Join the DARA 00x and DASD 00x with care and use the four screws left over. Two screws at the topside, two screws at the bottom side. For normal crane-installations, do **not** insert the two screws along the left rear side of the unit. These two screws are only for extremely vibrations, and if these screws are installed one has to take out the combined DASD 00x and DARA assembly.
- Join the DASD 00x and the DARA 100x modules with final joining screw+nut, see picture:
  Use screw M5 + nut.

- Firing pulse cable
  DARA 1000: Connect the firing pulse cable to the board DAPC 100 (X7). Study the fixing of the factory installed cable inside DARA 1000, remove this cable and connect and fix the cable from DARA 00x in the same way, using the cable ties of the package.
  DARA 1001 and DARA 1010: Connect the to the board DATX 132 or DATX 133 (X7).
- Fan connection
  DASD 002: Connect the fan to DARA power supply module DASA 110, -X2: 3 and :4. Red to :3 and blue to :4.
  DASD 003: Connect the fans to DARA power supply module DASA 110, -X2: 3 and :4. Two leads shall be put in the same terminal. Red to :3 and blue to :4.

Before connecting the fans: Check if the application design includes temperature control. In that case the red fan wire is connected via DO no. 1 of the DARA 10xx.

6.3. Panel lay-out

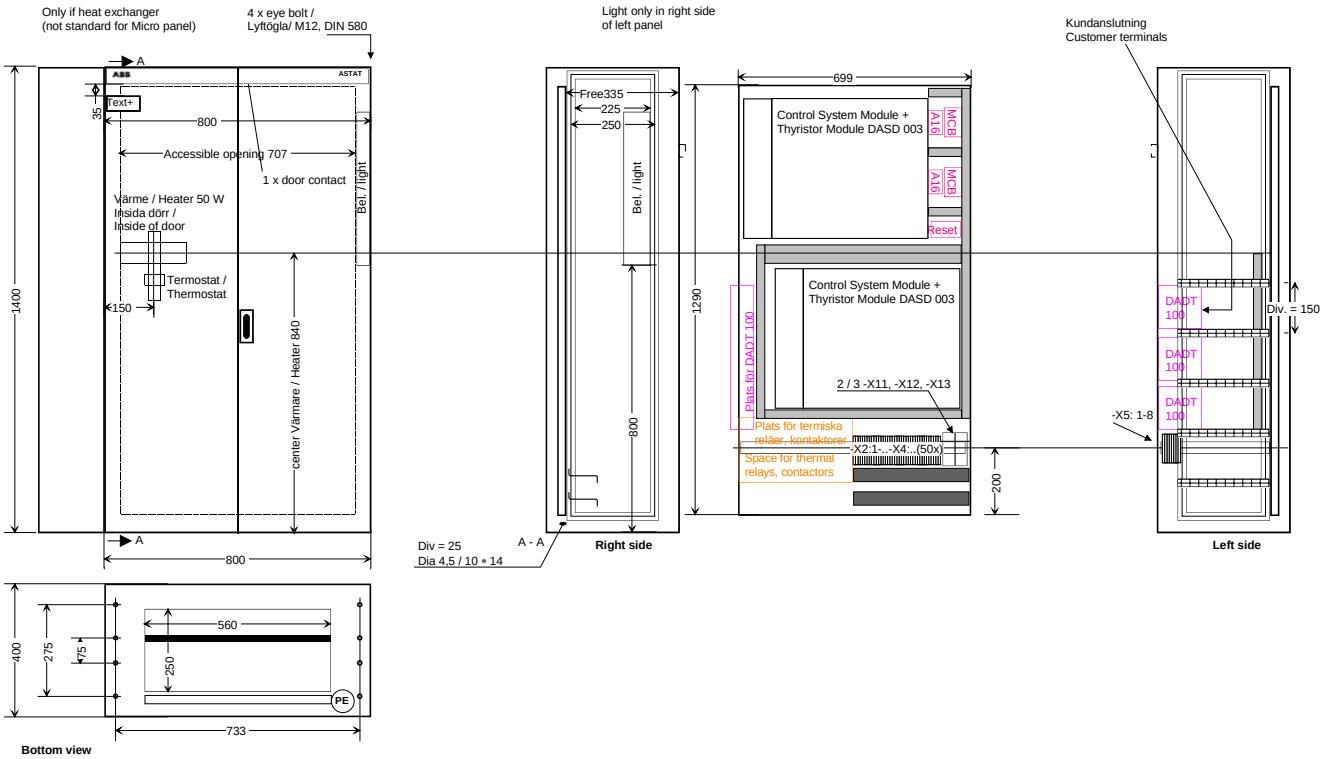
See our suggestions in following pages:

With an "E-room" is assumed a modern full height compartment. The panel height is 1800 mm, and is it convenient for cabling if there is approximately 300 mm additional free space on top of the panels. A false floor for cabling below the panels is also assumed. ASTAT panels can be installed in open panels in E-rooms as the EMC-emission is acceptable for EC-Directive and EN-norms in that execution. No additional protection barrier for dust / dirt is needed as ASTAT is made for pollution degree 4.

Motion controllers mounted in freestanding cubicles are mostly used for modernisation and smaller cranes. In both cases it is essential that the dimensions are small. We suggest to use cubicles with WxHxD = 800x1400x400 mm, and that the cubicle has **double doors**. For panels with width = 1200 mm we recommend **triple doors**. All connection should be to through the bottom of the cubicle.

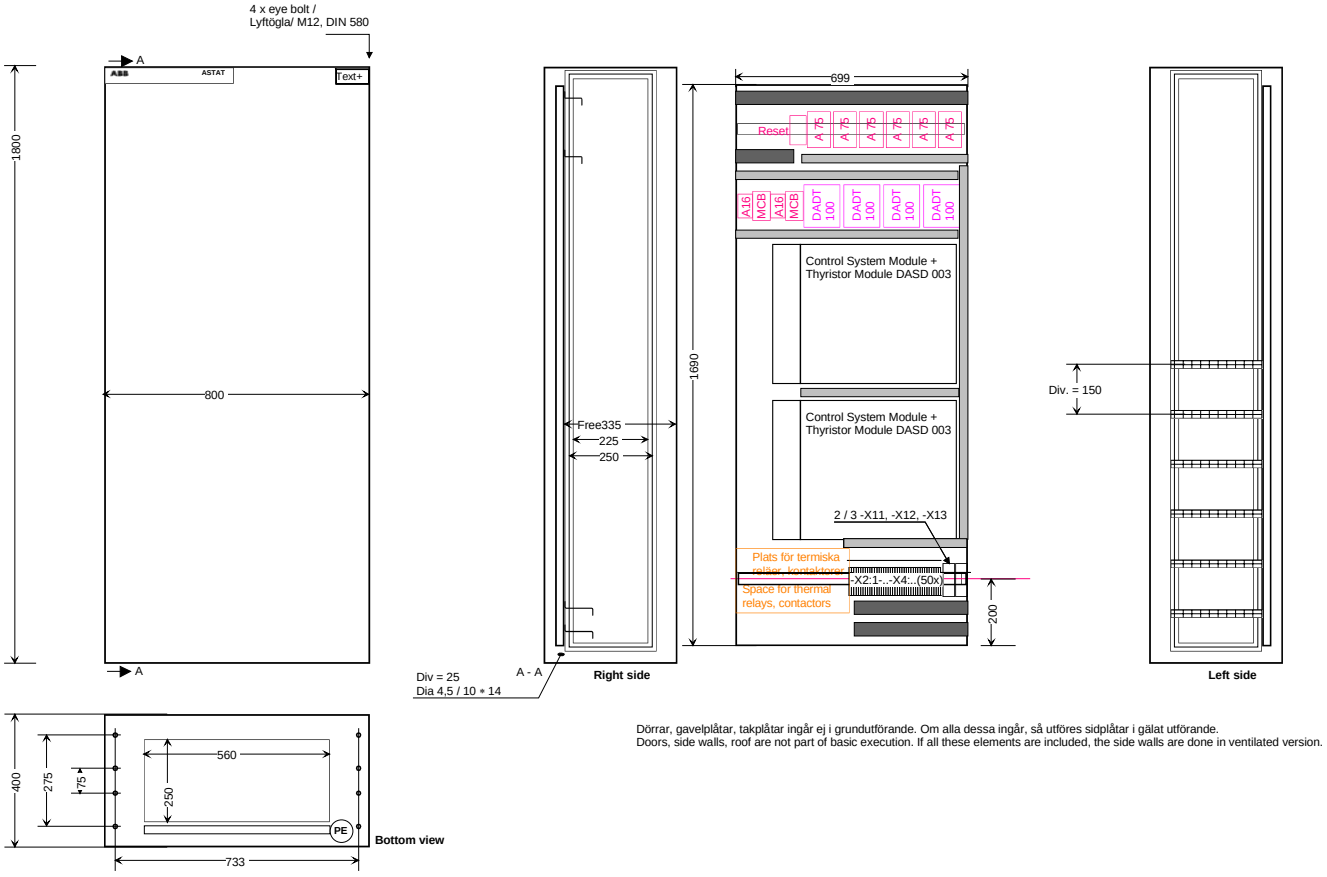
Contact ABB Crane Systems for more layout suggestions for switch or junction boxes, power distribution etc.

6.3.1. Cubicles with DASD 00x modules



Rotor connections to bottom. WxHxD of cubicle = 800x1400x400 mm. Space for two DARA10xx + DASD 00x.

6.3.2. E-room panels with DASD 00x modules

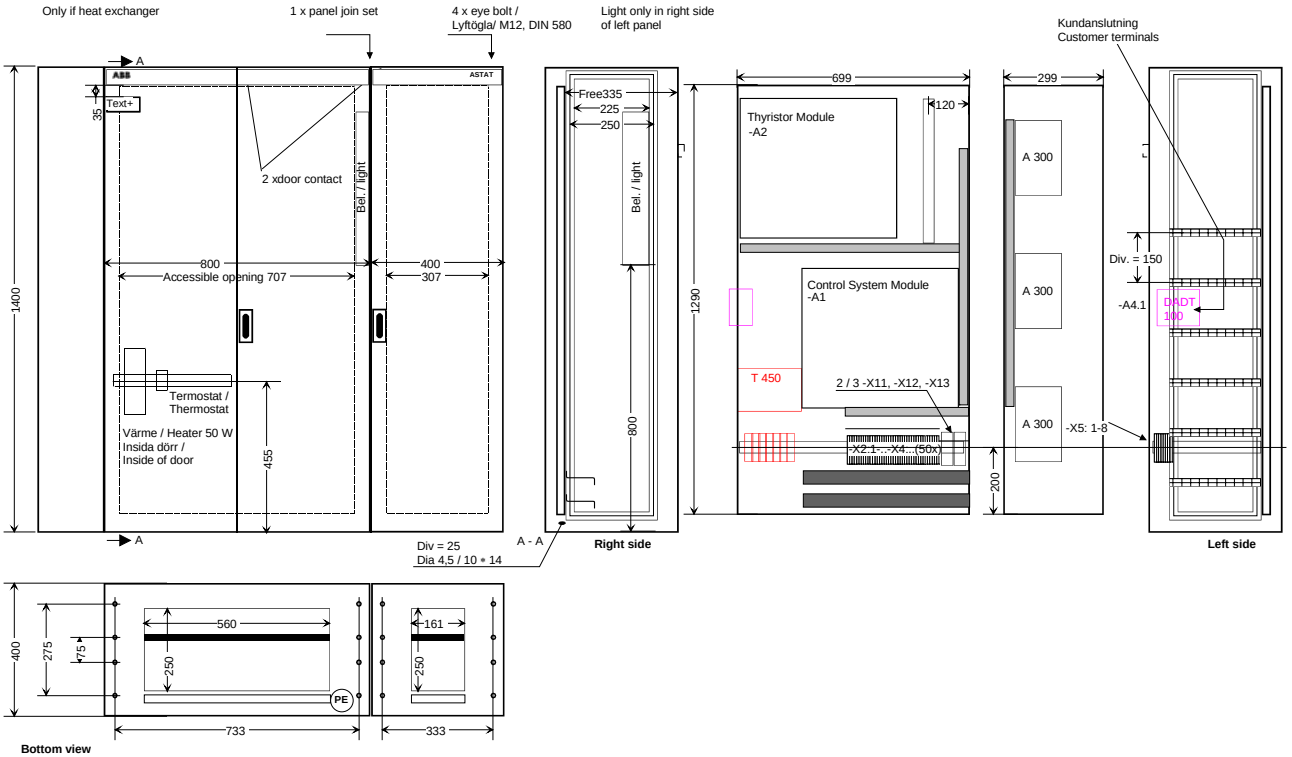


Dörrar, gavelplåtar, takplåtar ingår ej i grundutförande. Om alla dessa ingår, så utföres sidplåtar i gälat utförande.
Doors, side walls, roof are not part of basic execution. If all these elements are included, the side walls are done in ventilated version.

Rotor connections to top. WxHxD of panel = 800x1800x400 mm. Space for two DARA10xx + DASD 00x.

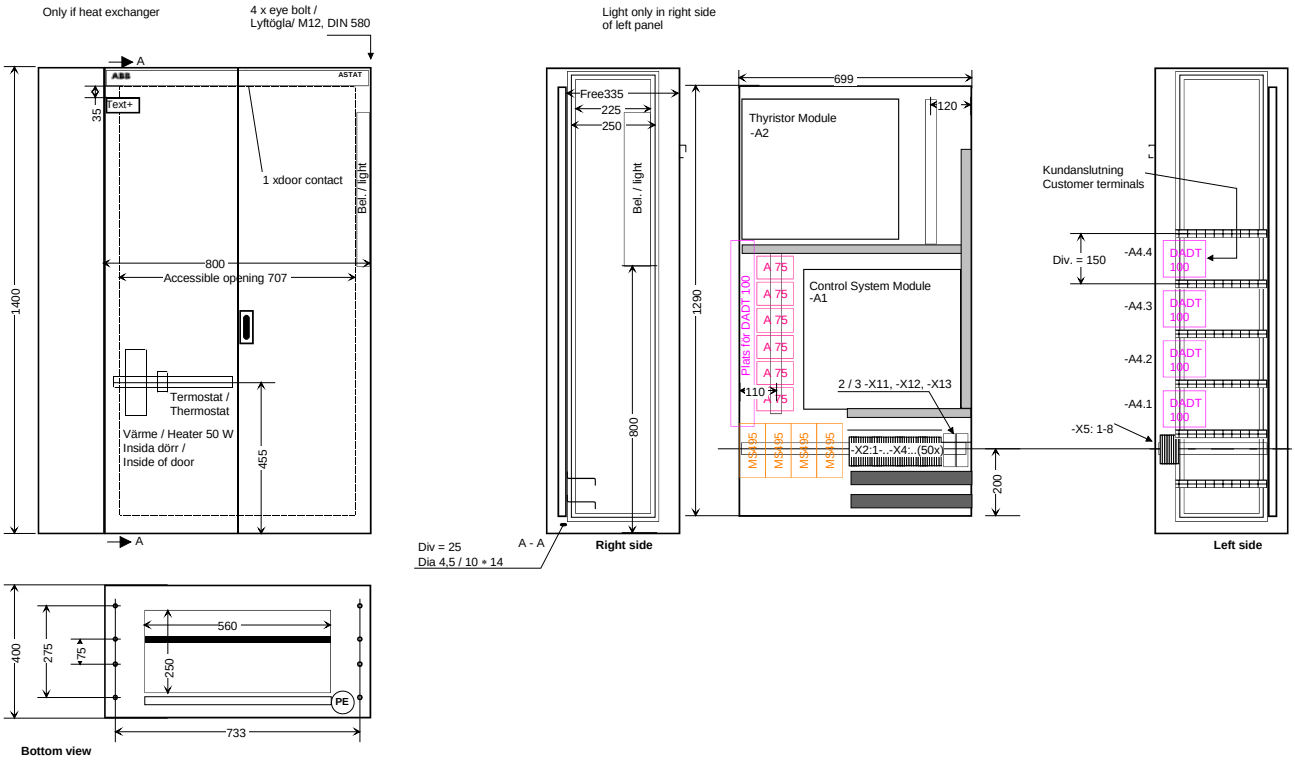
6.3.3. Cubicles with DASD 104-105 modules

6.3.3.1. Example width = 1200 mm



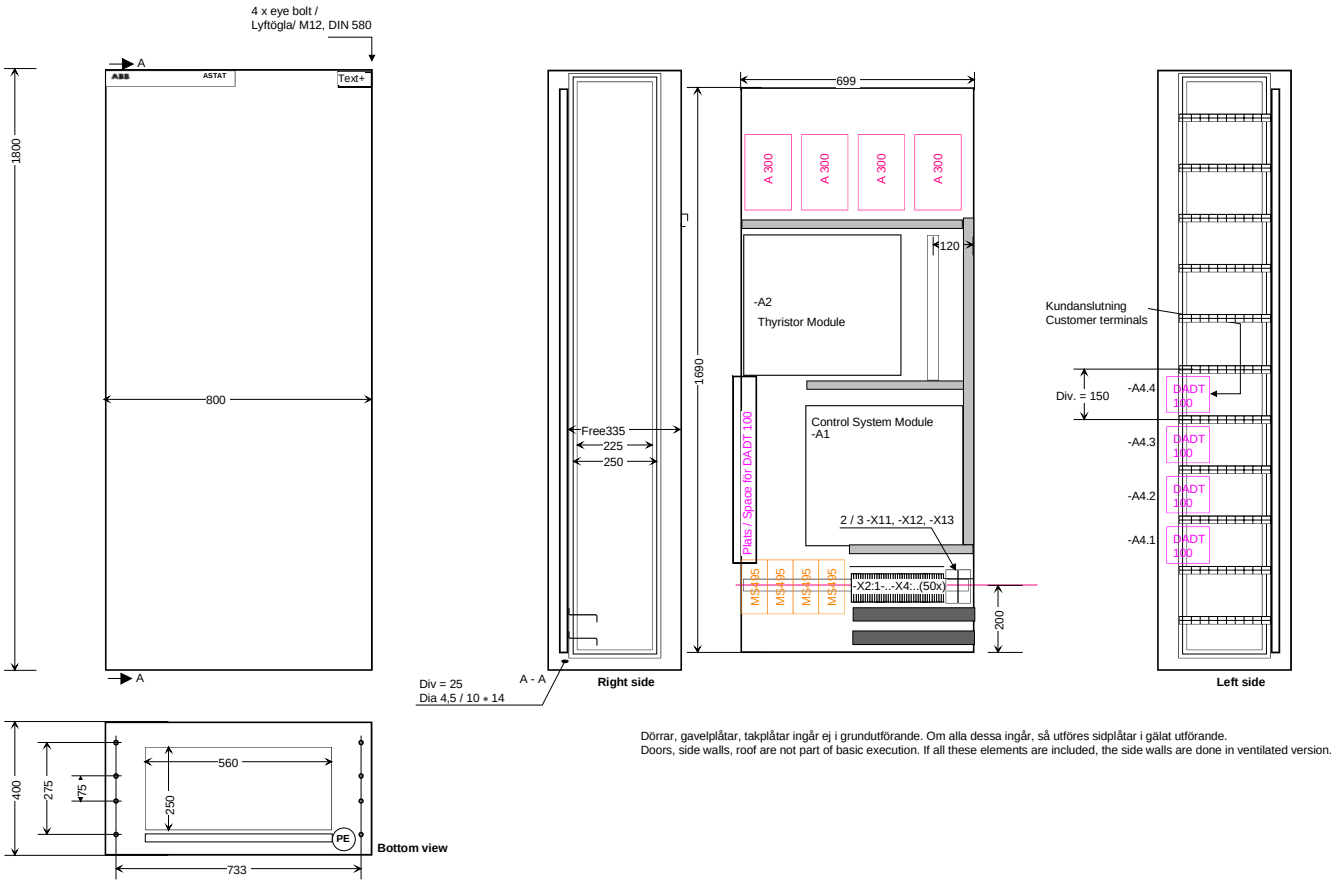
Rotor connections to bottom. WxHxD of cubicle = 1200x1400x400 mm. A separate compartment for the large rotor contactors. Space for one DARA10xx + DASD 105.

6.3.3.2. Example width = 800 mm



Rotor connections to bottom. WxHxD of cubicle = 800x1400x400 mm. Space for one DARA10xx + DASD 105

6.3.4. E-room panels with DASD 104-105

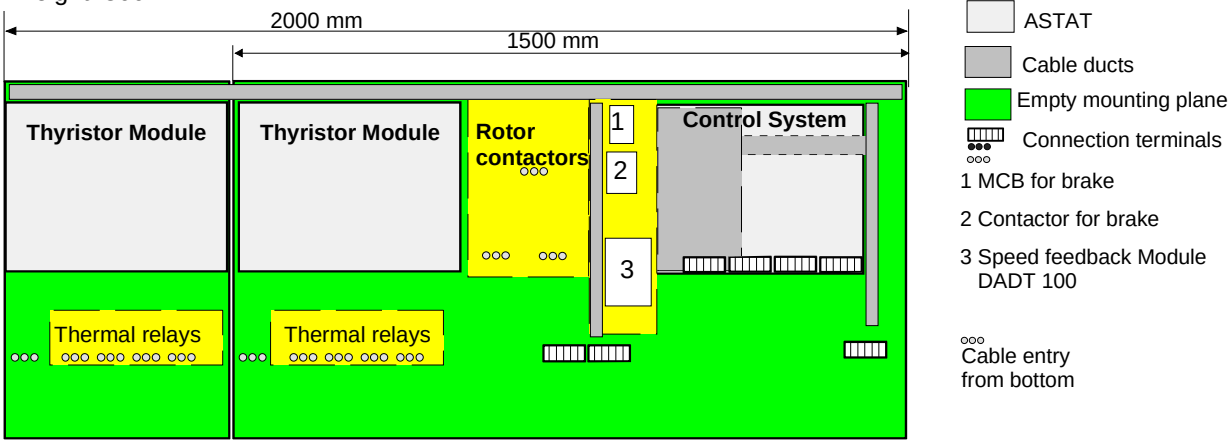


Rotor connections to top. WxHxD of panel = 800x1800x400 mm. Space for one DARA10xx + DASD 105.

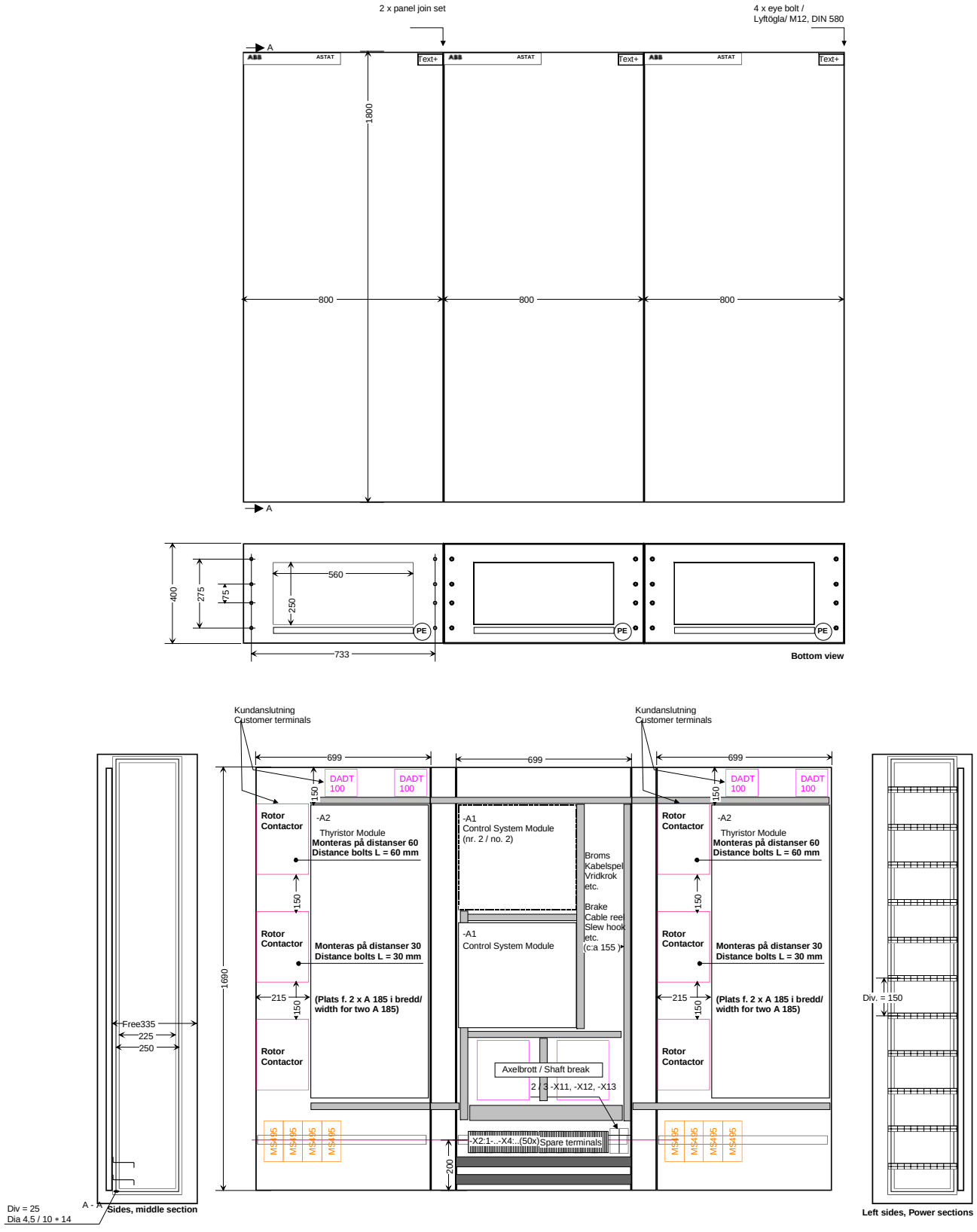
6.3.5. Cubicle with limited height

Cubicles can be assembled with a low height. For 355 A and less 1500 mm wide cubicles can be enough. Parallel 355 A modules, 710 A requires at least 2000 mm width.

Width: 1500 or 2000
Height: 800



6.3.6. Large E-room panels



Dörrar, gavelplåtar, takplåtar ingår ej i grundutförande. Om alla dessa ingår, så utföres sidplåtar i gålat utförande.
Doors, side walls, roof are not part of basic execution. If all these elements are included, the side walls are done in ventilated version.

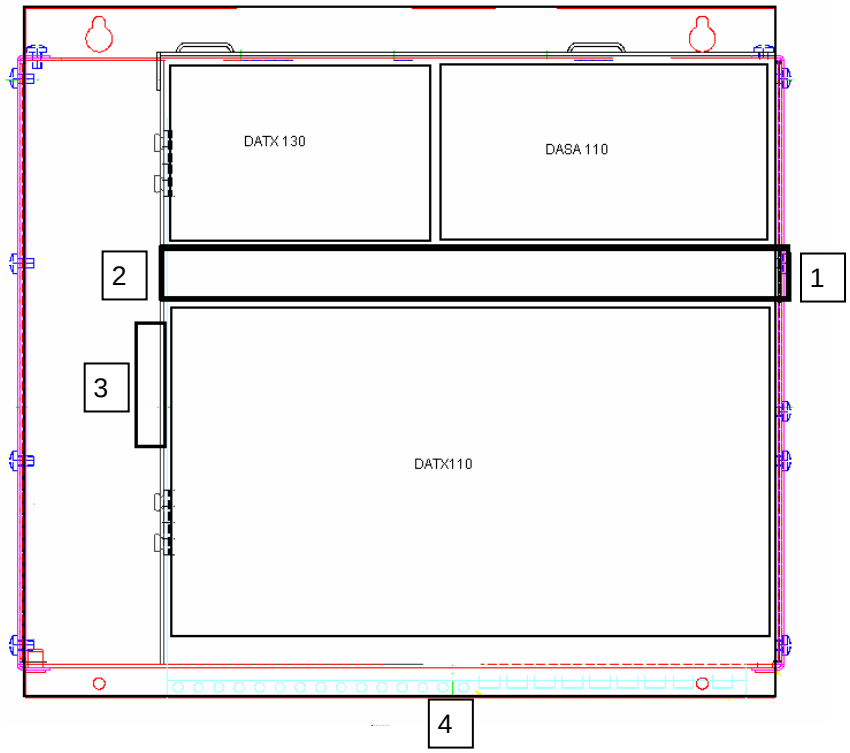
Rotor connections to top.
WxHxD of panel = (800 + 800)x1800x400 mm. Space for two DARA10xx + one DASD 127.

For parallel bridges, add 800 on left or right side to get 1260 / 2000 / 2200 A, or two independent drives of each 630 / 1000 / 1100 A.

Observe that the number of Rotor contactors and number of Thermal relays shown in the layout are not occurring in the same installation.

6.3.7. Routing of cables to DARA

The EMC tests for ASTAT are carried out with the different types of connections to DARA arranged in the below way. The picture shows the DARA with the hinged mounting sheet opened totally.



References numbers for the boxes in the above figure:

1) **Pulse cable to Thyristor Module DASD, 115 / 230 V AC supply, Fan supply, Opto fiber to Cabin I/O, RS 485 communication to computer**.
Inside fitted the wire duct.
Wires out on right side.

Then DASD 00x thyristor modules are used, the Cable from DADT 100 and Digital Out cables shall used exit 1, while the Pulse cable is using exit 2.

2) **Cable from DADT 100 (not for DASD 00x)**.
Inside fitted the wire duct.
Wires out on left side into vertical duct.
Can be routed up or down inside the vertical duct.

3) **Digital Out (not for DASD 00x).**
Wires out on left side into vertical duct.
Use cable ties in punched holes to fix the wires on lip.
Can be routed up or down inside the vertical duct.

4) **Digital In, PTC, Analogue In, Analogue Out, Pulse Encoder**.
Wires down.
Use cable ties in punched holes in DARA.
Use the fitted clamps for screened cables.

6.3.8. Power cables, terminals

General advice for Power cables is given in **Section 2.11**. Regarding the installation, we strongly recommend that terminals for power cables are used only if needed (like in junction boxes). The quality of the installation is improved by connecting the power cables directly to the main circuit apparatus in panels rather than by additional terminals.

Each additional power terminal will increase cost.

Each additional power terminal will increase future inspection work.

Acc. to EN60204-32 terminals are not needed for power cables.

6.3.9. Finish IP 20 protection of ASTAT

To achieve the IP 20 protection of Thyristor modules DASD 1.., following measures must be taken:

For sizes 200 A, 355 A, 630 A, 1000 A and 1100 A install a flameproof isolator protection cover over the main circuit cables or bars after they are installed. Lexan™ can be used. The cover shall be fit with ventilation holes D = 10 mm so at least 3 dm^2 and 1/3 of the cover surface is free for air ventilation.

Size 500 A fulfils IP 20 without any additional measures.

6.4. Cabin Indication unit

For the mounting of the unit four holes circular holes D=3,5 mm and one D=30 .. 60 mm are drilled or punched according to the dimension drawing.

If the delivered English text is not usable it can be replaced. Turn the unit upside down and loosen the circuit board for the unit by removing the inserted screws. Leave the transparent sheet in place.

Remove the English factory delivered text foil, and replace it by your own choice.

Put the circuit back, fasten the screws again. Turn the unit so the text can be read.

Remove the two screw covers (snap action).

Fasten the unit with four M3 screws. Restore the two screw covers.

Connect the 10-pole ribbon cable from the backside.

6.5. Speed Feedback Module DADT 100

Panel preparation in assembly workshop

(1) Install with at least two M4 screws using two of four holes diagonally.

(2) Open the protection cover by pressing the plastic latches out and swing it up.

(3) Install the PE-connector.

(4) Close by swinging down.

(5) Install the cable to DARA 1001 / 1010

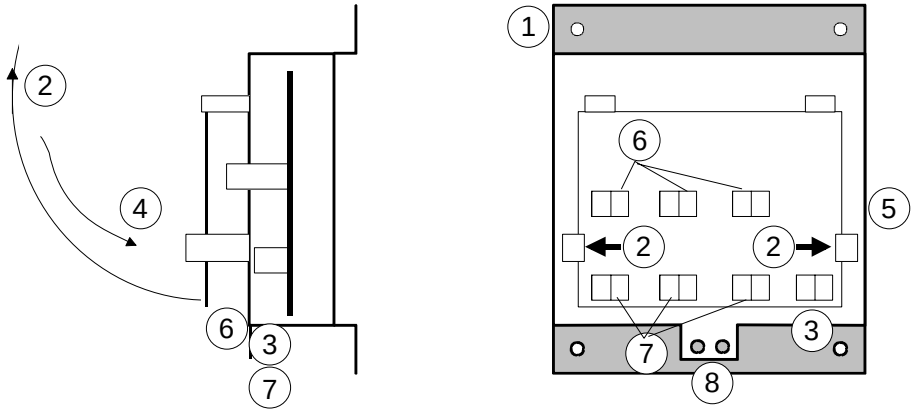
Site installation

(2) Open the protection cover by pressing the plastic latches out and swing it up.

(6), (7)Install the three cores of the cable for high rotor voltage, **max. rated 600 V**, (7) or low rotor voltage, **max. rated 300 V**, (6).

(4) Close by swinging down.

(8) Inserting a cable tie at (8) can support the cores of the cable.



6.5.1. Star point resistor

For control with rotor frequency feedback the star point ("the neutral") of the Rotor resistor must be connected to solid ground through a resistor R_Y. The motors rated Rotor Voltage is U_2 [V]

Data for R_Y: Resistance: R_Y = 50 to 150 kOhm.

Working voltage: $U_{WVR} = 2 * U_2$

Power: $\frac{(2 * U_2)^2}{R_Y}$

Example: A motor with a rated rotor voltage of 340 V is speed control by rotor voltage feedback. Select and install a resistor between the resistors star point and solid ground with following data: Resistance: R_Y = 100 kOhm. Resistors working voltage: 750 V AC. Power: 10 W (the high power was selected to get a mechanically robust device; from heat up point of view 5 W was enough).

Recommendation: Use the resistor 3ASC531201A550, which is listed in the order table. This resistor includes wire tails and mounting holes for screw and it easy to mount in the field.

6.6. Vacant

6.7. Tool modem sets DADT 114, 124

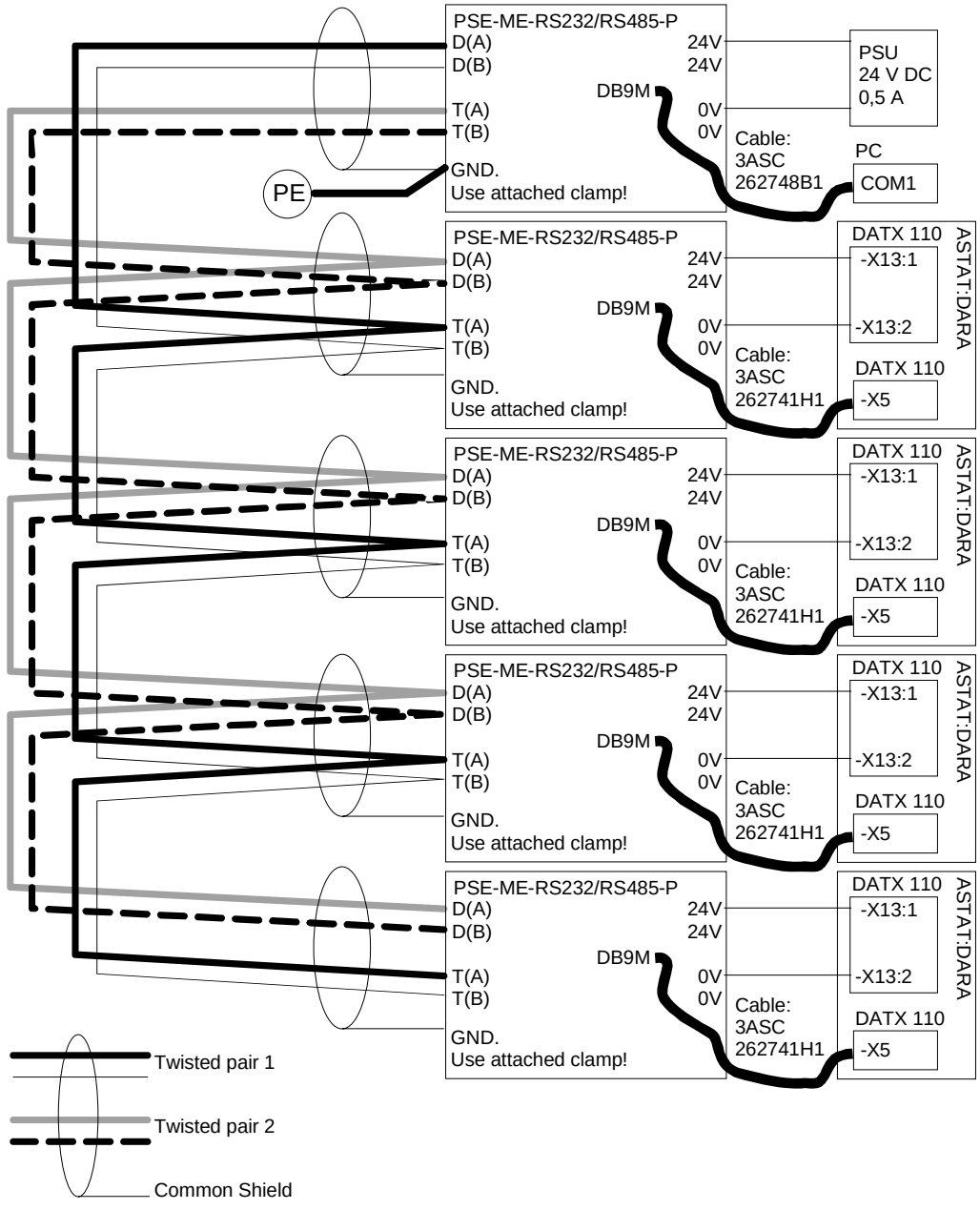
All devices are made for mounting on a 35 mm mounting rail. The mounting rail shall be connected to ground potential.

The cables that are connected to the signal converters shall be stripped using a stripping tool preset to 7,0 mm.

6.7.1. Cable for modems

Pair wise twisted 2 x 2 x max. 0,5 mm^2 with common shield. Do not use any inner individual shield for each pair. The cable LiCY (TP) 2 x 2 x 0,5 can be used.

Connection: See below:



Cable: LiYCY (TP) 2 x 2 x 0,5 mm^2

Jumper setting: See **Reference Section**.

The common shield of the data line cables shall be connected with the shield clamp at each signal converter.

Prior to energising the signal converters, check that the polarity of the 24 V is correctly connected.

6.8. Screened signal cables, general

Shielded cables, as far as possible with pair twisted cores, shall be used for:

- RS 485 multi-drop for Tool communication
- Tachometer / Pulse transmitter
- PTC-sensors
- Other analogue signals if used, example load cell transducer

The routing and grounding of RS 485 multi-drop is described in previous page. For other connections with screened signal cables we have following rules to consider:

1) Maximally 20 mm wire visible outside the end of the screen
2) Screen shall be grounded directly by a spring pressure clamp, or with a tail less than 20 mm long. If grounding is made through capacitor, the length of the capacitor legs shall be as short as possible.
3) Only in one point the grounding of each screen network shall be made direct to ground.
4) In all other grounding points the grounding shall be made by a 0,022 microF / 250 V AC (1000 V DC) capacitor. Properties: Application: Y-type filter capacitor meaning it is made to be installed between live and ground; Design: Metalised paper (self healing); Capacitance: 0,022 microF; Voltage:250 V AC (1000 V DC). **Example: Evox Rifa, PME 271 0,022 microF**.
5) The direct grounding of the screen is made in the control system module DARA 1000 / 1001 / 1010. It is not allowed to install any terminal strip in the cubicle / panel. The cable with screen shall be directly connected to the DARA 1000 / 1001 / 1010 and its fit spring pressure clamp. Example: Pulse encoder for hoist on trolley. Example: PTC for crane travel motor.
6) For screened cables from DARA to a transducer without passing any junction box, leave the screened cable screen isolated[remark] in the transducer end. This cable must be fixed directly to the steel structure of the crane or conduits should be used, not for example laid on a cable ladder. Example: PTC for crane travel motor.
7) For cables routed by junction boxes it is many times needed to use screened cables suitable for mill duty in the festoon part. It is shown on next page how junction boxes shall be designed.
8) For screened cables from trolley junction box to a transducer, leave the cable screen isolated [remark] in the transducer end. This cable must be fixed directly to the steel structure of the crane or conduits should be used, not for example laid on a cable ladder.
9) Keep the unscreened ends of the screened cables apart from other control and power voltages.
10) Keep signals from same transducer close to each other in cables, if possible as twisted pairs.

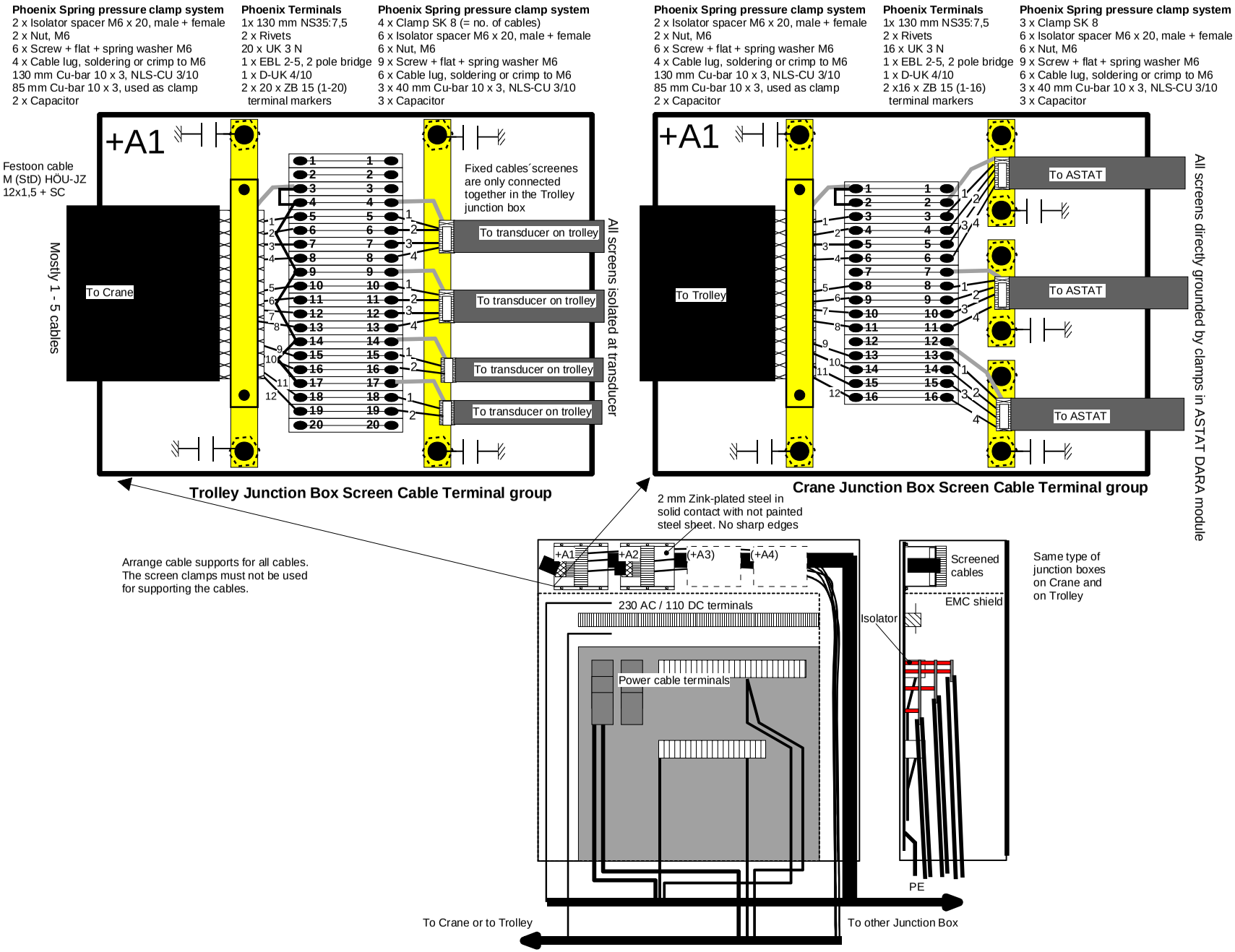
For cranes use flat cable systems, or if desired round cable festoon systems. With cranes it is not possible to use a large number of 2-, 4- or 8-core shielded cables in these installations for the festoon system. In stead other considerations must be made.

A sketch over cable arrangement for cable with common screen in junction boxes is shown on next page. Observe that nothing prevents to use the same box for power, control and signals if the arrangements are properly done.

The power cable terminals are placed in the lower part to minimise cable length, cost and voltage drop.

If of any reason a frequency controlled drive system is used for any motion on the crane, its cable system must be installed separately from the rest of the installation.

[remark] The method is a compromise between the best capacitor-grounding and practical considerations for crane installation


Phoenix Spring pressure clamp system
2 x Isolator spacer M6 x 20, male + female
2 x Nut, M6
6 x Screw + flat + spring washer M6
4 x Cable lug, soldering or crimp to M6
130 mm Cu-bar 10 x 3, NLS-CU 3/10
85 mm Cu-bar 10 x 3, used as clamp
2 x Capacitor
Phoenix Terminals
1x 130 mm NS35:7,5
2 x Rivets
20 x UK 3 N
1 x EBL 2-5, 2 pole bridge
1 x D-UK 4/10
2 x 20 x ZB 15 (1-20)
terminal markers
Phoenix Spring pressure clamp system
4 x Clamp SK 8 (= no. of cables)
6 x Isolator spacer M6 x 20, male + female
6 x Nut, M6
9 x Screw + flat + spring washer M6
6 x Cable lug, soldering or crimp to M6
3 x 40 mm Cu-bar 10 x 3, NLS-CU 3/10
3 x Capacitor
Phoenix Spring pressure clamp system
2 x Isolator spacer M6 x 20, male + female
2 x Nut, M6
6 x Screw + flat + spring washer M6
4 x Cable lug, soldering or crimp to M6
130 mm Cu-bar 10 x 3, NLS-CU 3/10
85 mm Cu-bar 10 x 3, used as clamp
2 x Capacitor
Phoenix Terminals
1x 130 mm NS35:7,5
2 x Rivets
16 x UK 3 N
1 x EBL 2-5, 2 pole bridge
1 x D-UK 4/10
2 x16 x ZB 15 (1-16)
terminal markers
Phoenix Spring pressure clamp system
3 x Clamp SK 8
6 x Isolator spacer M6 x 20, male + female
6 x Nut, M6
9 x Screw + flat + spring washer M6
6 x Cable lug, soldering or crimp to M6
3 x 40 mm Cu-bar 10 x 3, NLS-CU 3/10
3 x Capacitor
+A1
Festoon cable
M (StD) HÖU-JZ
12x1,5 + SC
Mostly 1 - 5 cables
To Crane
Fixed cables´screenes
are only connected
together in the Trolley
junction box
To transducer on trolley
To transducer on trolley
To transducer on trolley
To transducer on trolley
All screens isolated at transducer
Trolley Junction Box Screen Cable Terminal group
+A1
To Trolley
To ASTAT
To ASTAT
To ASTAT
All screens directly grounded by clamps in ASTAT DARA module
Crane Junction Box Screen Cable Terminal group
2 mm Zink-plated steel in
solid contact with not painted
steel sheet. No sharp edges
Arrange cable supports for all cables.
The screen clamps must not be used
for supporting the cables.
+A1
+A2
(+A3)
(+A4)
230 AC / 110 DC terminals
Power cable terminals
Isolator
Screened
cables
EMC shield
PE
Same type of
junction boxes
on Crane and
on Trolley
To Crane or to Trolley
To other Junction Box

7. Start up

This start up procedure is written as a verification of a thought through parameterisation design at the office desk in the previous stage.

If somebody likes to make the design by trail and error at start up there is nothing that prevents it, but remember in this case to start with a consistent set of parameters. This way of working is however less effective than to arrive to the crane with the design parameters ready from office.

ABB does not guarantee that the parameter setting ex works in the ASTAT controllers is the same as Normal values for visible and not visible parameters. Of this reason, when receiving a brand new ASTAT controller, the first parameter transfer shall be Send To ASTAT.

7.1. Safety precautions

7.1.1. Personal safety

CAUTION!

- **!** Follow all applicable rules regarding personal safety.
- **!** All people concerned must know how to disconnect mains and auxiliary voltage.
- **!** Do not perform any kind of work on the controller if there is any risk of touching live parts.
- **!** Do not perform any start up work alone.
- **!** Inform people working near the driven machine that it may start without prior warning.

7.1.2. Equipment

The following precautions should be taken to avoid damage to the machine, rotor resistors and drivers equipment:

- Check the equipment for damage during transport or installation.
- Check that all cables and plug-in components are fixed properly in terminals and at other connection points.

7.2. Tools

An ASTAT unit can normally be commissioned without sophisticated equipment:

- Digital Multimeter, ranges: Voltage: 0-1000 V DC and AC, Resistance 0,1 Ohm resolution or better
- Set of screwdrivers. Including Torx.
- Set of spanners of metric type.
- Pair of side cutters
- Pairs of tongs to move jumpers
- Laptop PC with (normal) COM 1 port, or Laptop with USB port and USB/Serial converter
- PC-Tool for ASTAT Crane Motion Controller. Including cable.
- For cranes with closed electrical room it is strongly recommenced to use Tool modem sets DADT 114, 124 to install the PC in a place with good vision of the crane movements.

7.3. Check list before power up

Make the following checks vs. the parameter list of the motion and the circuit diagram:

- That the ASTAT controller is connected to the correct mains and auxiliary voltages.
- That the fuses for the mains and auxiliary supply are present, and have right type and rating.
- That the cables, controller and motor are provided with appropriate external thermal overload protection.
- That the brake is properly installed and connected.
- That the rotor resistor is connected. Check by measurement the value of the rotor resistor if needed. Check the sequence of contactors K3 (DO4) - K2 (DO3) - K1 (DO2). K3, if installed, is closest to the motor.
- That the Rotor feedback Module, pulse-encoder or tachometer is connected properly when used.
- That the emergency-off switch functions correctly.

7.4. Start up step by step

7.4.1. Initial steps

Isolate the ASTAT from Mains and Auxiliary voltage by removing fuses or lock any circuit breaker with padlock. In case of a Shared motion drive, isolate also the second motion between ASTAT and motor.

Check wiring vs. circuit diagram. Check the tightening of power cables to ASTAT, resistor and motor. Isolate all DI and PTC-inputs with the yellow separators of DATX 110.

Check jumpers vs. circuit diagram.

Check the address switches of the remote I/O modules.

7.4.1.1. Control of digital inputs

Pull out all connected DI voltage separators of DATX 110.

Isolate (=Trip) the MCB for 24 V DC in the Control System Module.

Switch on the Auxiliary voltage, 115 (110) or 230 (220) V AC.

Switch on the MCB for 110 V DC in the Control System Module. LED 110 V OK on DATX 110 shall lit up.

For a floating system check that the MCB 110 V DC does not trip when connecting 110 V DC to ground. The LED Earth fault on DATX 110 shall lit up.

In case there are parallel bridges, check the function of the asymmetry protection by the LED Unsymmetry on DATX 110.

Check all other DIs 1 -16 by one by one closing the separators of detection voltage distribution terminal separators and all used digital input signals of DATX 110. Include the circuits inside and outside the panel in the checking.

End the test by checking that the digital inputs are in such a combination that the motion can start:

Type	With Cabin I/O	Without Cabin I/O
DI 1	ON: **1**	ON: **1**
DI 2	Fault reset: **0**	Fault reset: **0**
DI 3	Station 2 select: **0**	Master switch in zero position: **1**
DI 4	Parameter set 2 select: **0**	Step 100%: **0**
DI 5	All other for which the	Prelim Dir. A: **1**
DI 6	USE_DIxx-parameter[13] is 1: **1**	Prelim Dir. B: **1**
DI 7		Stop Dir. A: **1**
DI 8		Stop Dir. B: **1**
DI 9		Cable relay: **1**
DI 10		Brake open: **1**
DI 10		Dir. A: **0**
DI 12		Dir. B: **0**
DI 13		Mech. Overload / Cable relay: **1**
DI 14		Step 2: **0**
DI 15		Mech. Overspeed / .... : **1**
DI 16		Step 3: **0**

7.4.1.2. Control of PTCs in motors

Check that the LED(s) on DATX 110 for which the USE_PTCx-parameter[14] is 1 are lit up.

7.4.1.3. Control of fans

Check that the fan(s) are rotating. If time control is used, set parameter **13.01** to 3 to test the fan.

7.4.2. Power up the control system

Connect the fiber cable(s) between Control System Module and Cabin I/O Module(s), DAPM 100, 101.

Connect the PC with Tool program.

Switch on 24 V DC MCB in the Control System Module.

Start the ASTAT Tool program in on-line mode. Check that it is possible to study different variables of the ASTAT. Signal 01.51, gives the program version, as example 01.04.

Make the start up using the same operator station (or local) and the same parameter set al the time.

For Shared Motion drives, first make one motion ready.

For Master-Follower applications, first do one motion ready and copy all applicable parameters to the other.

[13] Parameters 05.09 ... 05.20

[14] Parameters 05.05 ... 05.08

7.4.2.1. Verification / modification of the parameters

Select **Design View** for parameters, and check:

Group 01: Identity
Check only

Group 02: I/O units and Factory test
0: master switch connected to Cabin I/O
1: master switch connected to Cabin I/O #2 and signals mirror wise transferred Cabin I/O #1 - #3
5: master switch connected to DARA

Group 03: Supply information
Check only

Group 04: Motor information
Check only

Group 05: ASTAT information
If the design is made with parameter **05.04, L_SW_TYP = 2**, change for the first stage of the start up to value L_SW_TYP = 0..

Type of limit switch for movements. 05.04, L_SW_TYP

0: Limit switches not active

1: Classic based on four switches.

2: Soft based on Pulse transmitter.

Rest of parameters: Check only.

Group 06: Brake information
Check that the designer has selected the right type of brake. The default values will always serve as a first getting started set if given the right type of brake is selected. Note down your changes if any.

Group 07: Speed feedback
Check that the designer has selected the right type. The speed feedback must be proven in a later stage with main power up.

Group 08: Speed reference
Check the parameter values.

Use the PC Tool to check that the reference value and the direction signals are properly interpreted by the ASTAT when moving the Master switch or whichever way the reference is given.

Group 09: Speed regulator
Check only at this stage. The default values will always serve as a first get started set if there would be any doubt regarding the designed values. If you make changes, note down your already tested values to avoid tuning with same values repeatedly.

Group 10: Speed supervision
Check only.

Group 11: Current regulator
Check only.

Group 12: Rotor resistor
Check only.

Group 13: Selectable DO
Check only.

Group 14: Load functions
Type of limit switch for movements. 14.01, MEC_OV_L

0: not used,

1: DI in Direction A,

2: DI in Direction B (Used for luffing cranes),

31 / 131 / 41 / 141: AI in Direction A. Check also rest of parameters in the Group

32: AI in Direction B (Used for luffing cranes). Check also rest of parameters in the Group

Group 15: Slack rope function
Check only.

Group 16: Limit switch function

Check only if the intention is to use the soft limit switch function.

Group 20: Master Follower

Check only.

End the test by pulling out the yellow separator of the DI no.1, ON, is 0 (the LED is out) and will remain 0 also then the main voltage is switched on.

7.4.3. Power up the main system

CAUTION!

! During this stage the motor can run at full speed without prior warning.
The motion shall be as lightly loaded as possible.

Switch on the Main voltage.

Check the phase sequence and voltage level with the ASTAT Tool program or with the display of the DAPC 100 board. Wrong sequence or a missing phase will result in Fault.

Make the ASTAT ON (DI no.1). The display of DAPC 100 shows an error code if there is any Fault.

For software before AST10_04: If no Fault, it will show the CPU-load of the control system in percent for Pulse Encoder / Tachometer speed feedback or the Rotor frequency in Hertz for Rotor frequency feedback. In case there is an error code, remove the source and make a Fault Reset (DI No. 2) or OFF + Fault Reset (DI No. 1).

For software including AST10_04 and later. If no Fault, it shows program version and revision letter, "40" for AST10_04 without revision. "41" is reserved for "A" **first** revision of AST10_04 etc.

At this stage is shall be possible to drive the motion. Move it gently in both directions to check that it is following the commands. The crane shall not be loaded. Direction A must be upwards for a hoist.

1) If the motion runs away in the correct direction: Check connection of the Rotor feedback Module or polarity of pulse-encoder / tachometer.
2) If the motion runs away in the wrong direction: Check (change) the main circuit connection sequences from ASTAT to motor.
3) If the motion can be controlled, but moves in the wrong direction: Check the phase / polarity of pulse-encoder / tachometer. Check (change) the main circuit connections sequence from ASTAT to motor. Check the direction commands A and B as well as polarity of analog signal from master switch.
4) If the motion does not move at all, there can be various explanations:
   Function of the brake
   Any DI has been changed

Give full reference. Check for both directions that the speed is approximately the rated of the motor, and that there is full main voltage out to the motor from the ASTAT.

At this stage the motion is basically controlled. Follow the procedure below to verify all included functions.

7.4.3.1. Brake function

Check the function of the brake as set up in parameter group 06.

Check the Fault handling system with respect to Brake supervision.

Check the lifting of the brake. Adjust Slow opening brake compensation (Group 8) and Tacho / Encoder supervision (Group 10).

7.4.3.2. Limit switches

Move the machinery to a position that is between Pre limit switches A and B.

If the design is made with parameter **05.04, L_SW_TYP = 2**, read first the description in section Functions

If the design is made with parameter **05.04, L_SW_TYP = 1**, move machinery in direction A to first be limited in speed with Pre limit Dir. A and finally stopped with Stop Dir. A.

Move back in direction B until the machinery first be limited in speed with Pre limit Dir. B and finally stopped with Stop Dir. B.

Move back to the in between zone there you started.

Test impossible combinations of limit switches to provoke Limit switch Fault.

7.4.3.3. Overspeed supervision

7.4.3.3.1. Absolute value trip

This is only applicable for Hoist motions or similar motions with a pulling load.

Check the Fault handling system with respect to Speed supervision.

Testing of speed deviation should be done after regulator tuning. Parameter 07.01 can be temporary set to 10, 20 or 30 and parameter 10.30 set to 0.

Pre testing

For setting **10.01, OSP_TYPE = 1** move the machinery and simulate first an overspeed by opening the digital input.

For setting **10.01, OSP_TYPE = 2** change temporary parameter **10.02** to half its value, and then move the machinery to simulate an overspeed. Restore 10.02.

For setting **10.01, OSP_TYPE = 3** no pre testing is needed.

Full testing

Discuss with the customer if full testing is required, as the ASTAT will stop the motion by other means before reaching overspeed, so full testing of the Speed supervision requires manipulation of the safety system.

7.4.3.3.2. Reference tracking trip

The Reference tracking system introduced in 10_05 will detect overspeed earlier than a fixed setting centrifugal switch or similar, and can stop the system with either working brakes or emergency brakes in coordination with the working brakes in case the reason is an electrical failure to avoid the heavy stress from the emergency brakes.

Identity	English text	Description
1030	USE_OSPT	The system is developed to early detect any electrical fault that will lead to dangerous situations, but can be stopped with only the high speed brakes. The system is most used in large hoist mechanisms. ASTAT can not be reset without control voltage off, like an overspeed trip. 0: Reference tracking system off 1: Reference tracking system on. Emergency stop of the crane will come directly, as DO 8 opens. 2: Reference tracking system on. Emergency braking will not occur, as DO 8 remains closed. Use for installations with emergency brakes.
1031	TRK_DIFF	For a hoist, except in the conditions given by **10.32** and **10.33** it is not allowed that the actual speed measurement gives a value **10.31** or more less than the reference with tendency to fall down.
1032	TRK_OCTL	For a hoist, except in the condition given by **10.33** it is not allowed that the actual speed measurement in Open control mode gives a value **10.32** or less with tendency falling down.
1033	TRK_BRCH	For a hoist it is not allowed that the actual speed measurement in Bridge changing state gives a value **10.33** or more less than the reference with tendency falling down.
1034	TRK_TIME	For a hoist it is considered that the Open control or bridge changing mode is preventing optimal control for the time **10.34** after the Open Control was finished, or the new bridge started.
1035	TRKDELAY	Although there are conditions to set the fault signal OSPTRACK (**21.91**), there is a delay time **10.35** before the fault is issued.

7.4.3.4. Selectable DO

Check the function of the device as set up in parameter group 13.

7.4.4. Tuning of parameters

Unless the motion properties need tuning by using the special functions, it can be completely adjusted by the parameters that are listed below, i. e. the Start Up view of parameters.

The Monitor Tool of the CMT is very important for Tuning. A recommended multipurpose setting of Signals can be:

1)	07.51	{Actual speed, filtered}	NACTMV	-125% .. +125%	(Green)
2)	08.51	{Speed reference}	N_REF	-125% .. +125%	(Blue)
3)	11.53	{Actual current}	IS_ACT	0% .. 400%	(Red)
4)	05.67	{Rotor cont. K1}	RCON_K1	Boolean	(Brown)
5)	05.68	{Rotor cont. K2}	RCON_K2	Boolean	(Black)
6)	05.70	{Brake lifter}	BR_LIFT	Boolean	(Grey)

Note that you can save and recall this setting! You can keep three different settings in your computer.

In which order to change:

Always at the final installation site, parameter 02.10 must be 0

Identity	English text	Description
0210	FACT_RUN	Run crane factory test program. No interlocking, works in soft starter mode. Must be set to 0 at delivery from the crane factory. This is a subject of safety.

Ramp times for acceleration and deceleration are sometimes changed. Times can be shorter with ASTAT than most other controllers: **08.02** and **08.03**

Identity	English text	Description
0802	ACC_TIME	Set time in ms. Typical value for a Hoist: 1250 - 2500 ms Typical value for a Travel: 2500 - 6000 ms 0 will give acceleration on Torque limit. This parameter has no influence for Acceleration control travel motions.
0803	RET_TIME	Set time in ms. Typical value for a Hoist: 1000 - 2000 ms Typical value for a Travel: 2000 - 5000 ms 0 will give acceleration on Torque limit.

Dynamics of the crane

Study the crane and set a suitable value for its dynamic properties.

This parameter 11.10 rescales the motion control system to handle different dynamic properties. The dynamics are limited both by the mechanism itself and the type of feedback. By experience has follow setting been found very successful:

- Good mechanics + tachometer. Set **11.10** = 1,00
- Average mechanics + tachometer or good mechanics + rotor feedback. Set **11.10** = 1,15
- Average/bad mechanics + rotor feedback or Bad mechanics + tachometer. Set **11.10** = 1,30

Identity	English text	Description
1110	ISCALVAL	Controls the systems dynamics. Typical setting in some situations: Good mechanics+tachometer allows 1,00. *Values < 1,00 are sometimes used.* Average mechanics+tachometer or good mechanics+rotor feedback allows 1,15 Average/bad mechanics+rotor feedback or Bad mechanics+tachometer allows 1,30

All other settings important for the dynamics are found in **Drive optimisation** below.

Speed regulator: Use the monitor function of the ASTAT Tool. Study signals 7.51 and 8.51:

Be prepared to increase 10.15 to a higher value during the tuning of the speed control.

Integration part of speed regulator. 09.02, N_KI. Final testing for motions with Super synchronous lowering shall be with full load.

First start with Normal values for 09.35, .40. 16, .17. 18 and 19.

Tune 09.02 and 09.03 to get acceptable values. For higher ambition, make iterations with 09.35↔09.02 and 09.40↔09.03 to differentiate as much as possible for speed change and steady state and highest possible gain in both situations.

At the end, see if there can be any improvements by changing one by one 09.16 .. 09.19.

If needed, in most situations with cranes with high dynamics there can be almost total overlap of reference and actual value.

Identity	English text	Description
0935	KI_RD_SS	For most motions the behaviour of the drive is better if the Integral gain is higher during speed changing than in steady state. By setting this parameter larger than 0 the Integral gain will be reduced during steady speed compared to during change. Leave as default = 50% for regular applications.
0940	KP_RD_SS	For most motions the behaviour of the drive is better if the Proportional gain is higher during speed changing than in steady state. By setting this parameter larger than 0 the gain will be reduced during steady speed compared to during change. Leave as default = 25% for regular applications.
0902	N_KI	Integration part of speed regulator. Higher value gives more integration. Adjustment for hoists is mostly to a higher value. Note the option to have higher gain during non-stationary speed, parameter **09.35**. Start with 0,050 for a hoist, 0,020 for Travel. For a hoist with super-synchronous lowering, test with full load, so the I-part is not too small. Many Travels can be tuned to a good result with I-part = 0,000. For travels the value can mostly be 0,000. Bad or complicated mechanical drive gear requires a lower value for travel motions. With **09.26** = 1 the Integral part can be set higher, servo properties are improved, without getting any over-/undershooting. **For Torque control, set 0,000.**
0903	N_KP	Proportional part of speed regulator. Higher entered parameter value gives higher gain. Adjustment is mostly to a higher value. Note the option to have higher P-gain during non-stationary speed, parameter **09.40**. **Always set 1,000 for Torque Control.**
0946	KP_ADD00	Increased action of the Speed controller Proportional part at 0% speed. The value entered is relative to **09.03**.
0916	KP_ADD10	Increased action of the Speed controller Proportional part at 10% speed. The value entered is relative to **09.03**.
0917	KP_ADD25	Increased action of the Speed controller Proportional part at 25% speed reference The value entered is relative to **09.03**.
0918	KP_ADD50	Increased action of the Speed controller Proportional part at 50% speed reference. The value entered is relative to **09.03**.
0919	KP_ADD99	Increased action of the Speed controller Proportional part at full speed reference. The value entered is relative to **09.03**.

A motor with rotor **frequency control makes jerk at start**

The motor needs more magnetisation time before it gives any rotor feedback.
Increase 17.27 first to 1000 to look for improvement, and after that reduce as much as possible.

Identity	English text	Description
1727	MAGN_DEL	For some (small) motors it is needed to let the motor build up the rotor voltage before it is acceptable for rotor frequency feedback. The need of a time longer than 0 is noted by a false interpretation of low speed as zero speed, and the motion can make a single jerk before it gets stable control mode. 0 ... 1 second. Normal 0 s = 0 ms. Set time in ms. If needed, a value around 500 ms can be tested.

Slow lifting brake Use the monitor function of the ASTAT Tool. Study signals 7.51, 8.51, 11.53 and 05.70:

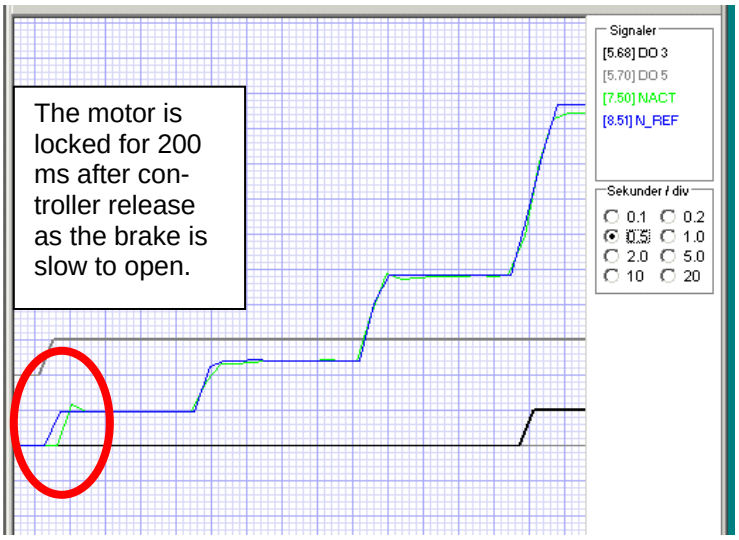
It is possible to hold the speed reference at zero at start before the brake has opened. With time, or time interrupted by limit switch "open". This function prevents competition between the motor and the brake as well as it reduces current/torque peaks.

A slow brake will cause wear of its own, bad regulation and high current/torque peaks.

An optimal setting is found during Start Up by studying Speed reference, Speed feedback and Actual current at the same time with the monitor Tool.

The Compensation for slow brake opening shall be considered and adjusted prior to increasing the monitor time for tachometer / encoder failure, parameter **10.15**. If no influence is noted, check if the designer has forgotten to activate the function with parameter **08.21**.

Identity	English text	Description
0824	DELA_TIM	Time corresponding to opening time of the brake, when the speed reference is kept at zero. See parameter 0821.



Speed supervision Use the monitor function of the ASTAT Tool. Study signals 7.51, and 8.51:

First restore **10.15** to the normal value 500 ms and see it is never tripping.

After that, see with load in the mechanism that no Fault 65 is coming when **10.19** is set to the normal value 1000 ms. If it trips in any situation, first reconsider the time.

Identity	English text	Description
1015	FEEDB_T	Time that no feedback at all is accepted.
1019	SP_DEV_T	Time that a speed deviation of **10.11** % of speed reference is accepted. Can be carefully increased if Speed deviation Fault is generated although the drive system is without any error

Mechanical brake Use the monitor function of the ASTAT Tool. Study signals 7.51, 8.51 and 05.70 :

The normal values of these parameters are such as they can be left without any modification for a mechanically good crane with well-tuned speed regulation.

Identity	English text	Description
0601	ZER_SPPC	Speed at which the mechanical brakes is applied. As a percentage of the synchronous speed 0 ..10%. Normal 2%.
0603	BRA_EL_T	Time, corresponding to at least normal closing time for the brake, during which the motor will be held with electrical torque after order to close brake. 0,1 .. 1,0 seconds. Normal is 0,1 seconds = 100 ms. **Set time in ms.** This time is ignored by travels.

What to do for a slow acting mechanical brake? Increase 06.01. Even 06.03 can need an increase. **Report the slow brake to the responsible person in charge as it might be a safety risk. Even if the load is well controlled in ASTAT duty, it can be a safety risk in case of emergency stop.**

Trying to get the best out of a travel motion with acceleration control:

IDENT	Text	Description
0701		Start with 10, 20 or 30 and tune the speed control, especially for retardation and low speed travel after hitting slow down limit switch. Switch to 14, 24 or 34 to continue with the acceleration control tuning.
0803		Retardation time (from full speed) that the travel motion will use when the master switch is moved to the neutral position, or when a limit switch is hit.
1015		The time as coasting with master switch in neutral is allowed without violating "Hold to run".
1101		Set as large as possible without getting mechanical stresses in the crane or parts of it when the master switch is moved from one extreme to the other.
0804		Subjectively perceived good acceleration for Step 1.
0805		Subjectively perceived good acceleration for Step 2.
0806		Subjectively perceived good acceleration for Step 3.

Trying to get the best out of a travel motion with speed control:

The control properties can in some situations be better if a low pass filter is inserted in the speed feedback. It might help for some travel motions. We can just recommend connecting the filter by setting 07.19 to 1, and studying the properties. If the control is good without this filter, there is no meaning to test it.

Test if the driver's comfort is better with the increased reverse current braking action connected. Watch out for Faults 65 and 71 if the motion is unable to follow the resulting reduced deceleration ramp.

Identity	English text	Description
0719	USE_FACT	A switch to connect the filter time of **07.20** also for the closed loop control, typically in case of non-performing mechanical drives system.
0720	NACTTC	Filter time for speed feedback for presentation. Also connected in the closed control loop if parameter **07.19** is set to 1.
0827	REV_RAMP	Used in manual operation of travel motions: If the driver pulls the lever to the opposite side than the actual motion, the retardation ramp time is reduced by the percentage value given by parameter **08.27**

Trying to get the best out of a hoist motion:

When stopping a hoist after hoisting, there is a risk for load setting when stopping. When stopping after lowering, there is no such risk. The solution is a slower ramp for the final part from Step 1 to stop. Parameters **0830** and **0831** take action. Normally the default values, "slower than 6% speed reference" and 2three times longer ramp" can stand without any modification.

Identity	English text	Description
0830	N_APPRCH	When stopping a hoist motion after lifting, but not after lowering, it is detected when the speed reference falls below the level set with **0830**. In this situation the ramp time is made a multiple longer than it is set as with parameter **0803**. As the time for this passage between the change in ramp slope and the setting of the brake is short, the increased stopping distance is possible to neglect. Undershooting and stresses in the brake disc/drum are reduced by this function.
0831	RATE_APR	The rate of which the deceleration ramp slope is increased at zero-speed approach.

Drive optimisation:

Drive optimisation is normally only done for larger drives. Motors with shaft height from 400 mm and larger together with the mechanical drive train should be treated with respect, and the experienced site engineer has to find out the best settings for smooth electrical and mechanical performance. The mentioned could also be valid for smaller motors.

Modify the current gain **11.03**, normal value = 10,000, by making it double, half etc. to find a better operation point. If it is found that it is stable for lower gain, but not for higher, lower the gain as much as possible without getting a slower response on speed change. In this situation you should once more try to increase the speed regulator gain; note that this might be an iterative process.

Identity	English text	Description
1103	US_KI1	Gain of current regulator. The current regulator is working with only integral gain. The value can be modified after careful testing. Travel motions can be better with reduced value of this parameter and higher speed regulator gain.

Check the scaling of the current feedback if not already done.

Identity	English text	Description
1110	ISCALVAL	Controls the systems dynamics. Typical setting in some situations: Good mechanics+tachometer allows 1,00. *Values < 1,00 are sometimes used.* Average mechanics+tachometer or good mechanics+rotor feedback allows 1,15 Average/bad mechanics+rotor feedback or Bad mechanics+tachometer allows 1,30

7.4.5. Special functions to set at start up

Opening the Special Parameter View Special all parameters of Design, Start Up and Special Views become visible.

A special selection of the Special functions parameters that must be set during start up, i. e. not possible to fix during design phase is presented below (this selection is not possible to get from the PC Tool).

Most times the Special functions parameters are not touched at all during the start up.

7.4.5.1. Brake manipulation

Identity	English text	Description
0606	BRA_DELA	Time for which the setting of the brake is delayed. The motion is electrically soft braked to eliminate sway. **Set time in ms.** This time is ignored by hoists.
1128	RED_INPC	Current limit for elimination of sway of travel motions by electrical braking with this current during the time defined by parameter 06.06. Normal value 100% current limit gives about 30% braking torque around zero-s peed.
0608	BR_REF_T	Time lag for the safety setting of brake based on the speed reference independent of the actual speed measurement. **Set time in ms.**

7.4.5.2. Speed control functions

Identity	English text	Description
0901	DER1_N	Derivation part of speed regulator. Higher entered parameter value gives more feed forward based on derivation of speed reference. Normally never changed from 0.
0909	SUP_SPPC	Value in percent of the motors synchronous speed for switching to super-synchronous braking. Normally not changed.
0933	REV_CUFA	During super synchronous lowering the lowering current is memorised. At notching back the rotor contactors are opened, and during the time set with **09.34** a current **09.33** times the memorised current is injected in braking direction. After this time, it is back to normal speed control In AST10_04, it is possible to modify the performance of the function; most modifications are made to reduce the fast notch back and allow a small load droop! This parameter is active only when speed feedback is made with rotor voltage frequency. For a time, defined as 09.34 ms, after exit from super-synchronous lowering, the current will be forced to 09.33 % of the historical current that was measured for the super-synchronous lowering phase.
0934	CURRTIME	This time starts when Super Synchronous lowering ends. If there is rotor freq. feedback, during this time 09.34 the speed control is replaced by plug braking with parameter 09.33 x the lowering current in Super Synchronous mode.

7.4.5.3. ...

7.4.5.4. Rotor resistor control

Normally the rotor resistor parameters are not touched at start up. If any of them must be adjusted, it can be a sign of that the design is made more critical than needed.

Identity	English text	Description
1208	HI_RES_A	12.08 = 1: Resistor step 4 is used in the hoisting at Step 1 after four seconds of no speed change. Typically used for tilting of ladles in the hot metal industry. Only used for cranes with step master switch, not for analog reference.
1217	SSTDIFK2	K2 is switching at the value set with 12.20, but the reference value before the ramp unit must the value of 12.17 higher than 12.20. With normal value settings K2 will only pull in with the master switch in full speed position.
1218	SSTDIFK3	K3 is switching at the value set with 12.21, but the reference value before the ramp unit must have the value of 12.18 higher than 12.20. With normal value settings K3 will only pull in with the master switch in full speed position.
1219	SW_K1	If there is enough torque, the full resistor can be used for low speed hoisting. The switch point of K1 is set with parameter 12.19
1220	SW_K2	K2 is switching at the value set with 12.20, but the reference value before the ramp unit must have the value of 12.17 higher than 12.20. With normal value settings K2 will only pull in with the master switch in full speed position.
1221	SW_K3	K3 is switching at the value set with 12.21, but the reference value before the ramp unit must have the value of 12.18 higher than 12.21. With normal value settings K3 will only pull in with the master switch in full speed position.
1222	HIST_K2	Hysteresis for contactor K2. Pulls in at speed set by parameters 12.20 and 12.17, drops at a slower speed. The difference is defined by 12.22.
1223	HIST_K3	Hysteresis for contactor K3. Pulls in at speed set by parameters 12.21 and 12.18, drops at a slower speed. The difference is defined by 12.23.
1224	USE_K0	If 0, Rotor contactor K0 will never pull-in
1225	USE_K1	If 0, Rotor contactor K1 will never pull-in
1226	USE_K2	If 0, Rotor contactor K2 will never pull-in
1227	USE_K3	If 0, Rotor contactor K3 will never pull-in
1139	CON_OP_T	If a slow breaking rotor contactor is used, ASTAT can perform the breaking with no current. The consideration of a slow contactor will give a longer time to change torque direction.
1229	CON_CL_T	If a slow making rotor contactor is used, ASTAT will delay the making of "redundant" contactors for Open control and Super-synchronous lowering in order to reduce to inrush current and voltage dip of the control voltage system.
1144	IS_ZER_T	Expected time in ms to reach current zero after giving zero current reference. Used for implementation of solid state contactor opening.

7.4.5.5. Load functions

The procedure is:

Before going to the crane find out settings for parameters of Group 14, 15 and 09.31, 09.32. Get acceptance for the settings from the crane's responsible engineer.

At the crane, check wiring, make sure that test weight are available.

Set parameters in the order they are listed in section **4.14.2** of this Manual, not 14.01, 14.02, 14.03 etc.

Save the parameters to safe back up.

Test all functions.

7.4.5.6. ...

7.4.5.7. Master-Follower control

Identity	English text	Description
2001	MF_TYPE	Definition of the role of the ASTAT in a Master-Follower connection. 0: No Master-Follower connection 1: Master in Master-Follower connection 2: Follower in Master-Follower connection
2002	MF_SCAL	The part, in percent, of the position difference between the two motions of the Master-Follower that the Follower will compensate as: **Follower Speed Reference =** **Master Speed reference ∗ (1+((MF_SCAL /100)∗Difference[15]))**
2003	TQ_RATIO	Part in %[16] of one of the two identical motors rated torque that shall be the difference in torque in torque follower mode. With positive sign the Follower is weaker
2005	MF_RAMP	The correction signal can be applied more softly by using a ramp function from actual to requested value. In most cases this ramp is not used, and by setting MF_RAMP to 0, there is no influence of the ramp. A value less than values of parameters 08.02 and 08.03 can give better performance when switching between sub modes MF1 - MF4

[15] With Difference it shall be understood:

Sub mode MF1, Electrical shaft:	Position difference
Sub mode MF2, Individual speed reference:	Follower is not controlled by any difference, so this parameter is not active
Sub mode MF3, Torque control:	Desired difference in torque
Sub mode MF4, Uniform speed:	Speed difference

[16] Only meaning for Sub mode MF3, Torque control

7.4.6. Functions to prove

A few functions can be proved after tuning is ready. In most installations these functions are not used.

7.4.6.1. Slack rope function

Moved to Load functions.

7.4.6.2. Check of second speed feedback device

If the speed feedback is made by redundant system (i. e. parameter **07.01, SPEED_FB**, has the value 21, 31 or 32) check the function of the back up device:

- Set the back up device as the normal feedback by temporarily changing SPEED_FB.
- After restoring SPEED_FB, disconnect the normal feedback device when operating the machine, to see that it stops.
- Check the Fault handling system with respect to Second feedback device.

Type of feedback. 07.01, SPEED_FB
10/13: Rotor voltage frequency.
20/23: Analogue tachometer.
21: Feedback Analogue tachometer and compared with the Rotor voltage.
30: Pulse transmitter.
31: Feedback Pulse transmitter and compared with the Rotor voltage.
32: Feedback Pulse transmitter and compared with an analogue tachometer.

7.4.6.3. Check of second operator station

Check the switch over function and the operation from the second operator station.

7.4.6.4. Check of different parameter set

Check the switch over function and specially the functions of parameters that have been given a different value in the second parameter set.

7.4.6.5. Check of fault handling system

Check the installed functions of the Fault handling system. Check that the Cabin I/O display is lit up correctly.

7.4.6.6. Shared motion

Keep the second motions main circuit isolated.

Check the switch over logic.

Make a complete start up sequence for the second drive in shared motion as already done with the first drive.

7.5. Final procedures

Save the AST-file in your PC.

Save a N-REF, N-ACT diagram as ASG-file for light load and full load.

Check that the drive equipment can be run in the intended way.

Tighten all terminal and bus bar connections.

Check that all components are fixed properly.

Restore the covers.

Run all motion once more from all operator stations.

8. Maintenance of ASTAT

8.1. Personal safety

CAUTION!

!	Follow all applicable rules regarding personal safety.
!	All people concerned must know how to disconnect mains and auxiliary voltage.
!	Do not perform any kind of work on the controller if there is any risk of touching live parts.
!	Control System Modules DARA .... are connected to maximally 250 V AC. Disconnect at its source voltage prior to perform any maintenance work of the DARA .... module.
!	Thyristor Modules DASD .... are connected to maximally 600 V AC. Disconnect all three phases at its source voltage prior to perform any maintenance work of the DASD .... module. The fans of the DASD .... modules are supplied from the DARA .... module. Also disconnect the fan supply voltage at its source prior to any maintenance work of the DASD .... module.

8.2. General

The controller contains no parts subject to mechanical wear except some pilot relays and, for some current ratings, one or two fans. In addition to the checkpoints below the controller requires only general upkeep to ensure reliable operation. This type of maintenance is common to all industrial electrical equipment and can therefore be included in general maintenance routines.

The controller should be inspected at regular intervals, determined by the nature of the operation and environmental factors (vibrations, humidity, dust etc.).

8.3. Cleaning

Use a vacuum cleaner.

Be careful to avoid mechanical damage of circuit board components.

An inspection should be made after this cleaning to detect mechanical damage, overheated components etc.

8.4. Plug-in components

Check that the connectors of the circuit boards and power pack are firmly in place.

8.5. Terminal connections

Tighten the main terminals L1 ... T3 and PE-connection.

Tighten the main fuses of DASD 106, 107, 108, 126, 127, 116 and 117.

8.6. Screwed joints

Check that the different units in the controller are screwed firmly in place and that there are no loose screws or nuts.

Check that no cables or leads wear against sharp edges.

8.7. Cooling air fan

Check that the fan(s) rotates freely and that there is no abnormal sound.

Check that the electrical connections are firmly in place.

9. Fault tracing

9.1. Basics

9.1.1. Personal safety

CAUTION!

!	Follow all applicable rules regarding personal safety.
!	All people concerned must know how to disconnect mains and auxiliary voltage.
!	Do not perform any kind of work on the controller if there is any risk of touching live parts.
!	Control System Modules DARA .... are connected to maximally 250 V AC.
!	Thyristor Modules DASD .... are connected to maximally 690 V AC. The fans of the DASD .... modules are supplied from the DARA .... module.

9.1.2. Introduction

The controller has a simple and functional design with few components and component units. All components and units are of high quality, and will of that reason be subjected to fewer faults than normal industrial electronic equipment.

The basis for the Fault tracing are the LEDs of the Cabin I/O unit DAPM 100, 101, which explicitly shows the most frequent faults and give reference to when it is needed to check the ASTAT controller in the electrical room. If there is no Cabin I/O unit DAPM 100, 101 installed, it is needed to check the two-digit display of the DARA 100x Control System Module to view any Fault code.

Except the power units with thyristors the components are the same throughout the range.

9.1.3. Component fault

First, it is more frequent that a fault has external sources than internally in the ASTAT controller.

The components are listed below in order of estimated fault frequency internally:

- Mechanical components
- Connectors and cables
- Circuit boards
- Power pack
- Fans
- Fuses
- Thyristors

The above can serve as a first guide for those tracing faults in the controller.

9.1.4. Working with voltage

When tracing faults, it may be necessary to work with the voltage switched on.

Follow all applicable rules regarding personal safety.

9.1.5. Equipment and tools

Beside the circuit diagram set and the parameter list for the ASTAT following equipment and tools are recommended.

- Digital Multimeter, ranges: Voltage: 0-1000 V DC and AC, Resistance 0,1 Ohm resolution or better
- Set of screwdrivers. Including Torx.
- Set of spanners of metric type.
- Pair of side cutters
- Pairs of tongs to move jumpers
- Cable tie spanner
- Draw out tool for Phoenix circuit board separators

In case it is needed to replace the board DAPC 100, the same installed program version and the parameter set that is stored in the DAPC 100 to replace must be entered in the new board:

- Laptop PC with (normal) COM 1 port, or USB-port with USB/Serial-converter
- PC-Tool for ASTAT Crane Motion Controller and cable.

In case it is needed to replace thyristors in Thyristor modules with puck thyristors the gate leads are soldered to the thyristors. The reason for this is a pay-off between risk for the leads to come out in case of heavy vibrations and the risk for a thyristor failure of other reasons.

- Soldering iron
- Soldering tin for installation of new thyristor.

Follow the instructions of the Tool to make this procedure.

9.2. Standard fault tracing scheme

Following the scheme below can identify most malfunctions in the equipment. The scheme should be followed step by step in the following order:

Error code	Note the LED annunciation and if needed the Error Code of DAPC 100. ASTAT will automatically try to reset all faults and restart the motion at main voltage power up, so to find error codes there are the following ways: 1) The display of the DARA is viewed before restart. 2) The PC Tool is used. 3) The error remains at power on.
Symptoms	Note the driver's observations in connection with the malfunction.
Electric power♠	Check the electrical power supply to the controller (mains and auxiliary) and the cable connections between the ASTAT controller, the motor and the resistor. Check main fuses (DASD 106, 107, 108, 126, 127,116, 117) and measuring fuses (all DASD).
Internal voltages	Check 24 V DC and 110 V DC. Look for instructions below.
External control♠	Do the external interlocking to prevent a release of the controller Attempt a manual start of the controller. Execute a manual release and reference generation.
Limit switches♠	Are the end, slow-down position and brake limit switches in order
Speed reference♠	Is the speed reference available. Is the external master control equipment serviceable
Speed feedback♠	Is the speed feedback available **and stable**?
Rotor circuit♠	Status of the slip rings and brushes. Status of the rotor resistors
Excessive heat / dangerous dust	Inspect the controller for overheated components and for excessive dust.

♠ Check for loose connections!

Faulty thyristor	Is a thyristor short-circuited in the reverse or off-state directions Check by measuring the resistance; < 100 Ω ≅ short circuit. Look for instructions below.
Settings on circuit boards	Check the settings of the circuit boards in relation to the updated circuit diagrams.

9.2.1. Process indication codes

The following codes are used to indicate errors detected internally or externally by the Control System Module.

For software including AST10_04 and later: If no Fault, it shows program version and revision letter, "40" for AST10_0**4** without revision.

In case there is an error, the display will toggle "F1" and the error code. Example: PHASE SEQUENCE WRONG will display F1-01-F1-01-F1-01.....

Generally: Load related signals would disappear when the master switch is returned to the neutral position. All other indications will remain until pushbutton "RESET" is pressed or Crane is turned ON. For most faults RESET will be disabled until crane is turned OFF. All non-persistent fault will disappear at the same time when pressing.

From release 10_054 the code will stay until reset is activated, although the motion is ready to run after a motion OFF -> ON sequence.

All start of motion, Fault or not fault, must be initialised by "ZERO POS-signal"

no.	Name	Action	How to Reset?
01	PHASE SEQUENCE WRONG or FREQUENCY OUT OF RANGE	Motion stopped	OFF
02	PHASE L1 MISSING	Motion stopped	OFF
03	PHASE L2 MISSING	Motion stopped	OFF
04	PHASE L3 MISSING	Motion stopped	OFF
05	LINE VOLTAGE L1 < Set level	Motion stopped	OFF
06	LINE VOLTAGE L2 < Set level	Motion stopped	OFF
07	LINE VOLTAGE L3 < Set level	Motion stopped	OFF
31	DAPC 100 ERROR	Motion stopped	OFF
32	DATX 110 NOT FOUND	Motion stopped	OFF
33	DATX 120:1 NOT FOUND	Motion stopped	OFF
34	DATX 120:2 NOT FOUND	Motion stopped	OFF
35	DATX 120:3 NOT FOUND	Motion stopped	OFF
36	MASTER-FOLLOWER ERROR	Motion stopped	OFF
37	DATX 130 NOT FOUND	Motion stopped	OFF
43	110 V DC TOO LOW	Motion stopped	OFF
44	110 V DC EARTH FAULT	None	OFF OR RESET
45	Not possible combination of direction and zero position signals from master switch	Motion stopped	OFF
46	UNBALANCE; PARALLEL BRIDGES	Motion stopped	OFF
47	ERROR IN THYRISTOR TEMPERATURE MEASUREMENT	None	OFF OR RESET
48	CRANE UNCONTROLLED STOPPED	Motion stopped (by itself)	CONTROL VOLT. OFF
49	4 - 20 mA load cell signal broken	None	OFF OR RESET
50	Mismatch of reference polarity and direc-tion signals of joystick	None	OFF
51	Manual operation: JOYSTICK NOT IN NEUTRAL SWITCHING WHEN SHARED MOTION WAS SELECTED / Computer operation: REMOTE OPERATION ABNORMALLY ENDED. MASTER SWITCH OUT OF ZERO or COMMUNICATION BREAK DOWN	Joystick must back to neutral before the new motion is active / Motion stopped	OFF
52	PTC TRIP no.1	Motion stopped	OFF
53	PTC TRIP no.2	Motion stopped	OFF
54	PTC TRIP no.3	Motion stopped / None	OFF or RESET if the PTC is for Warning
55	PTC TRIP no.4	Motion stopped / None	OFF or RESET if the PTC is for Warning
57	BRAKE NO ACK. no.1	Motion stopped	OFF
58	BRAKE NO ACK. no.2	Motion stopped	OFF
59	BRAKE NO ACK. no.3	Motion stopped	OFF
60	BRAKE NO ACK. no.4	Motion stopped	OFF
61	CABLE RELAY no.1	Motion stopped	OFF
62	CABLE RELAY no.2	Motion stopped	OFF

no.	Name	Action	How to Reset?
63	CABLE RELAY no.3	Motion stopped	OFF
64	CABLE RELAY no.4	Motion stopped	OFF
65	SPEED DEVIATION	Motion stopped	OFF
66	PULSE TRANSMITTER FAULT	Motion stopped	OFF
67	ROTOR FREQ. MEAS FAULT no.1	Motion stopped	OFF
68	ROTOR FREQ. MEAS FAULT no.2	Motion stopped	OFF
69	ROTOR FREQ. MEAS FAULT no.3	Motion stopped	OFF
70	ROTOR FREQ. MEAS FAULT no.4	Motion stopped	OFF
71	TORQUE FAULT	Motion stopped	OFF
72	OVERLOAD, DI	Motion stopped, Direction A (or B) blocked.	Master switch
73	OVERLOAD, AI	Motion stopped, Direction A (or B) blocked.	Master switch
75	OVERSPEED, DI	Motion stopped	CONTROL VOLT. OFF
76	OVERSPEED, CALCULATED	Motion stopped	CONTROL VOLT. OFF
77	OVERTEMP. THYRISTORS	Motion stopped	OFF
78	SLACK ROPE; SLOW DOWN	Stop as PRE LIMIT switch	Master switch
79	SLACK ROPE; STOP	Stop as STOP LIMIT switch	Master switch
80	NOT POSSIBLE LIMIT SWITCH VALUES	Motion stopped	OFF
81	EARTH FAULT ROTOR no.1	Motion stopped	OFF
82	EARTH FAULT ROTOR no.2	Motion stopped	OFF
83	EARTH FAULT ROTOR no.3	Motion stopped	OFF
84	EARTH FAULT ROTOR no.4	Motion stopped	OFF
85	UNSYMMETRICAL ROTOR no.1	Motion stopped	OFF
86	UNSYMMETRICAL ROTOR no.2	Motion stopped	OFF
87	UNSYMMETRICAL ROTOR no.3	Motion stopped	OFF
88	UNSYMMETRICAL ROTOR no.4	Motion stopped	OFF
89	TACHOMETER FAULT	Motion stopped	OFF
90	The brakes could withstand the applied test torque at start	Motion stopped	OFF
91	Hoist speed not able to follow the reference-based tracking. Overspeed risk.	Motion stopped	CONTROL VOLT. OFF

9.3. 24 V DC voltage

Check the MCB -F1 of DASA 110.

If tripped, disconnect the consumers of 24 V DC acc. to the ASTAT circuit diagram at end of this manual, and try to restore the MCB. Measure 24 V DC between (DASA 110)-X2:2 (plus) and :4 (minus). The value must be between 17 V and 33 V.

If this is impossible to restore, the fault might be internal in DASA 110.

Connect the consumers one by one, until the consumer that causes the trip is found, and causes a trip again.

If no consumer causes a new trip, check all consumers for internal faults.

The board DAPC 100 has LED 5 V OK (green).

The board DAPU 100 has LED 5 V OK (green).

The board DATX 110 has LED 5 V OK (green).

The board DATX 130 has a green LED for 15 V OK.

The board DATX 120 has LED 5 V OK (green);this board has mostly a different 24 V DC supply.

24 V DC is directly grounded, and can always be measured to ground.

9.4. 110 V DC voltage

Check the MCB -F2 of DASA 110. Check the LED 110 V OK (green) on DATX 110. In case there is a floating system for 110 V, check the LED Earth fault (red) on DATX 110.

If the MCB is tripped or there is an earth fault, disconnect the consumers of 110 V DC acc. to the ASTAT circuit diagram at end of this manual by opening the yellow separators on DATX 110, and try to restore the MCB. Measure 110 V DC between (DASA 110)-X2:6 (plus) and :7 (minus). The value must be between 55 V and 140 V.

If this is impossible to restore, the fault might be internal in DASA 110.

Connect the consumers one by one, until the consumer that causes the trip is found, and causes a trip again.

110 V DC is directly grounded or floating.

9.5. Circuit boards

If circuit boards must be replaced, the actual settings from the replaced board must be implemented on the replacement boards. When possible, the setting / jumpering is done on the connector rather than on the boards, and in that case no setting / jumpering is needed.

Handle all circuit boards with care mechanically and with respect to static electricity discharge.
Boards with variable software:

DAPC 100[17]

Boards with setting / jumpering:

DATX 110
DATX 120
DAPC 100[18]
DATD 100[19]

Boards without setting / jumpering:

DAPU 100
DATX 100
DATX 130 + DATX 132

Boards with plug in PROM (8 pin DIL):

DATX 130 + DATX 132

Boards that are part of Modules: DADT 100 and DASA 110.

[17] The Tool program, the file with extension AST for the motion, a PC and either a RS 232-cable or a RS 485 network must be available to replace DAPC 100.

[18] In most cases there will be no changes from the delivered state.

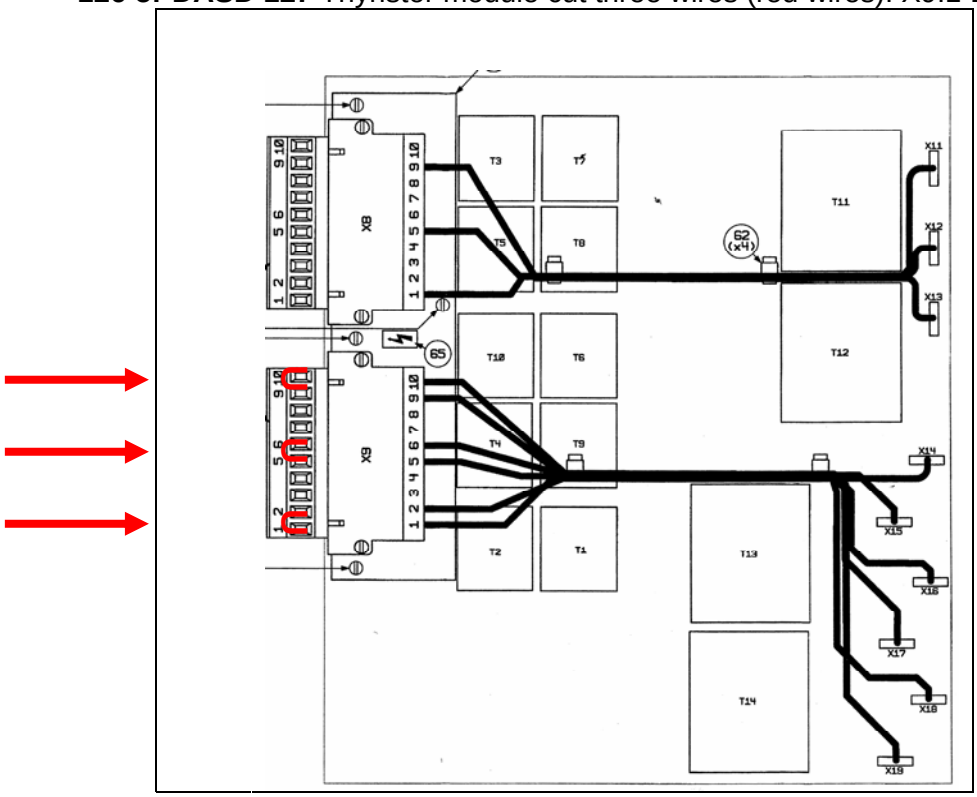
[19] In most cases there will be no changes from the delivered state.

To replace the board DATX 100 do as follows:

- Cut the cable ties holding the heat sink temperature sensors cable.
- Remove the rail that holds the gate cables in place.
- Pull out all plug-in connectors.
- If the board is installed in DASD 106, 107, 126 or 127 study and follow the notes below.
- Loosen, only a few turns, the two screws that hold the board base plate in place.
- Tilt the board base plate with the board to the right and pull it out.
- Replace the board on the board base plate. There are no jumpers on the board; all settings are made in factory on the connectors.
- Restore the board base plate in the opposite order as it was removed.

Special notes for DATX 100 manufactured after week 38 (September), 2005

Before this board is to be installed as replacement in a **DASD 106, DASD 107, DASD 126 or DASD 127** Thyristor module cut three wires (red wires): X9:1-2, X9:5-6, X9:9-10



If this board is installed as replacement in any DASD Thyristor module manufactured before September 2005, it is needed to take out the key guides from positions 3 and 4 of the five contacts -X1, -X2, -X3, -X4 and -X5, before installing the board.

Use the tip of a sharp knife.

9.6. Fans

9.6.1. Modules with two fans

A fan fault can cause an Over temperature in thyristor stack.

For DASD modules with two fans change both fans at one time. Use only the fans listed in the Spare Part list.

Do not cut any leads when replacing a fan, pull out the contacts from the old fan and insert into the new.

Be aware of the air direction, which is directed up.

The fan in DASD 102, 103, 112 and 113 (50 and 100 A) is simply loosened with screws from below and dismounted by gravity.

The fans in DASD 104, 105, 114 and 115 (200 and 355 A) are simply loosened with screws from below and dismounted by gravity.

The fans in older DASD 106, 107, 108, 126 and 127 thyristor modules with puck thyristors (630, 1000 and 1100 A) are screwed to a sheet, which is pulled out after loosening of its fastening screws. Prior to pull out this sheet, loosen the tinned thin copper conductors above the semiconductor fuses.

9.6.2. Modules with one fan

9.6.2.1. DASD 146, 147, 156 and 157

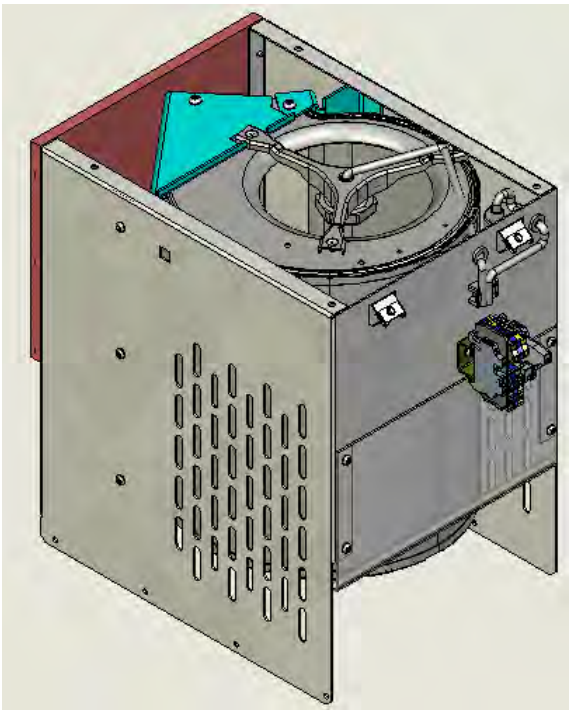
Newer DASD modules with puck thyristors, DASD 146, 147, 156 and 157 has one 230 V AC radial fan with dual side inlet. It has a discrete capacitor.

To replace the fan do as follows:

1) Disconnect the main supply and the fan supply to the DASD module, and prevent unexpected reconnection.
2) Remove the cover from the DASD module.
3) Remove totally 12 pcs. of M8 screws with spring and plain washers so the interconnection bars from fuse-holders to Al-cooling element extension flags are disconnected, although still physically fixed.
4) Disconnect the inside Grey-Blue-Green Yellow terminal plug to the fan unit.
5) Remove the M6 screws that hold the horizontal metal stabiliser. Remove the stabiliser, together with the interconnection bars from fuse-holders to Al-cooling element extension flags.
6) Take out the air supply unit by pulling the fan straight out.
7) Trouble shoot the unit. Replace fan or capacitor. When replacing the fan, replace always the capacitor at the same time.
8) Test the air supply unit.
9) Reinstall the air supply unit by doing the above listed measures in the opposite order.

9.6.2.2. DASD 145

The same fan and capacitor as for DASD 147 and 157 are used. The same spare parts can be used, see Section **Spare Parts List**. It is however relative time consuming to replace the fan, and of that reason a larger assembly, DAFU 145 (code 3ASC25H229) is available as spare. See picture below and spare parts list.



DAFU 145

9.7. Thyristor fault

9.7.1. Fast check

Try to run the motion at low speed in both directions. It might be possible, but with bad control properties. At the same time measure the **DC**-current of the three line phases one by one by means of a tong-type A-meter in DC-mode. In case of thyristor failure there is a significant DC-current in some of the phases.

9.7.2. Investigation after fast checking

Disconnect the main supply, for example by removing the line fuses, and disconnect the motor.

For thyristor faultfinding remove the six voltage measurement fuses and disconnect the gate connectors in the circuit board end. To avoid confusing results, it is also recommended to temporarily disconnect the RC circuit DASG 110 or DASG 111.

Start the trouble shooting with Multimeter in resistance range. This is mostly adequate as the most common thyristor faults result in short circuit or diode action of the devices.

If you cannot find any faulty thyristor but still suspect thyristor fault make the faultfinding with a thyristor tester. Use following voltages for testing depending of the rated voltage of the ASTAT Thyristor Module:

Rated voltage 415 V: Use 1200 V test voltage
Rated voltage 600 V: Use 1600 V test voltage
Rated voltage 690 V: Use 2200 V test voltage

All treatment of thyristors shall be with absolutely cleanliness. If more grease must be added after replacement follow the instructions for the grease used.

Use following tightening torque then restoring screwed / bolted connections without tell tale washers or spring indicators inside the thyristor bridges. The torque are valid both for electrical connections as well mounting of fuses (630 - 1100 A) and thyristor modules (25 - 355 A)[20]:

Size	Torque [Nm]	Torque [lbf.ft]
M5	6	4,5
M6	6	4,5
M8,	11	8
M8 in new range DASD 145, 146, 147, 156 and 157	20	15
M10	40	30
M12, Fuse	50	38
M12, Except fuse	80	60

[20] These torque are only used for repair of ASTAT Thyristor modules, and are not universally valid for the mentioned thread sizes.

9.7.2.1. Size 25 - 100 A and 500 A

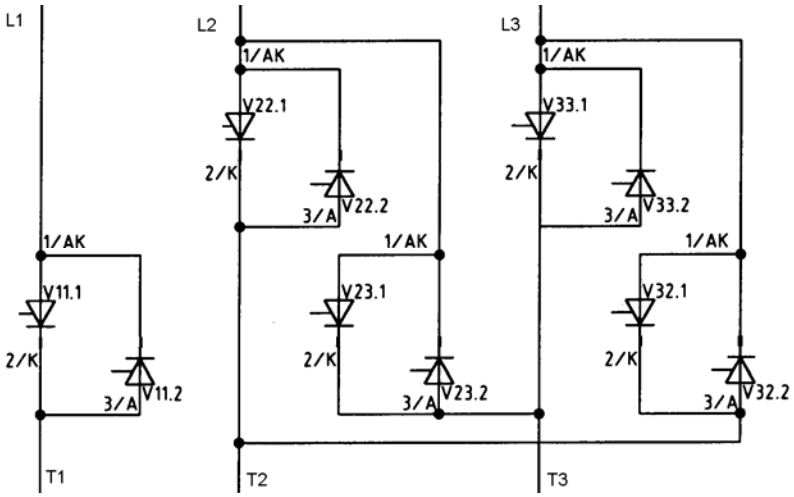


Diagram:

Measurement 1

Measure the resistances between: L1–T1, T1–L1. All values must be ≥ 100 Ω.

If there is a fault, the problem is in the lower device.

Normally, this is the only thyristor fault in the DASD ... Module.

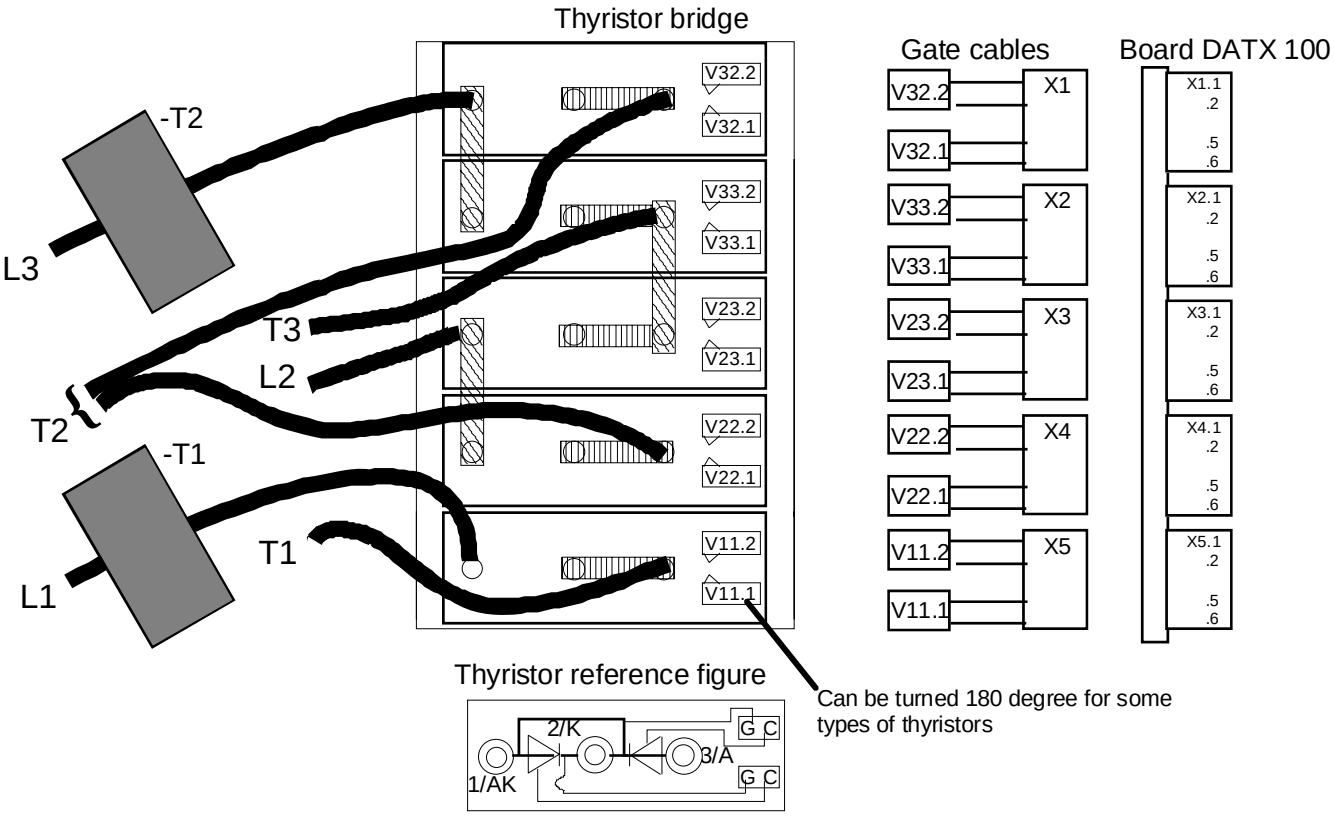
Measurement 2

Loosen the vertical connections and the three copper plates but restore the bolts and washers.

For each of the four upper devices, measure the resistance between: 1/AK and 2/K (which is linked with 3/A) All values must be ≥ 100 Ω.

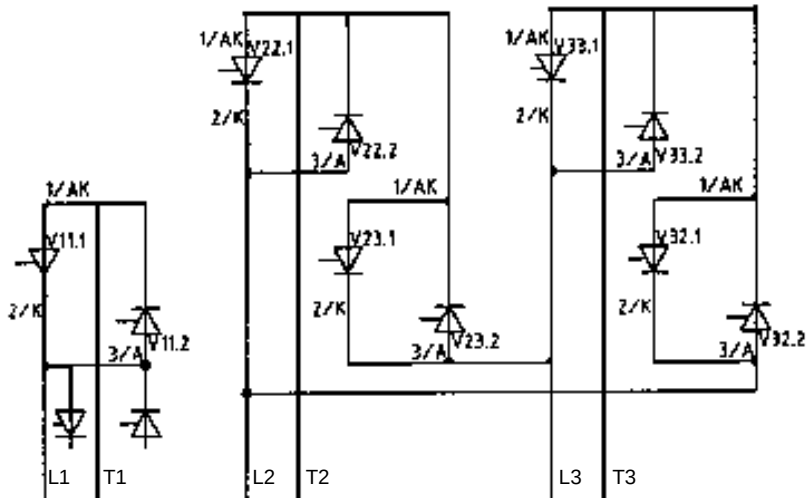
Replace the faulty thyristor.

When loosening bolts and washers we recommend restoring them in the original thread holes at once, as they otherwise can be mixed, and the connections will be erroneous or the devices can be destroyed.



9.7.2.2. Size 200 - 355 A

Diagram:



Measurement 1

Measure the resistances between: L1–T1, T1–L1. All values must be ≥ 100 Ω.

If there is a fault, the problem is in one of the two left devices.

Remove the left connection with straight lugs. Check which of the two possible thyristors that is faulty. Replace that thyristor.

Under normal conditions, this is the only thyristor fault in the DASD ... Module.

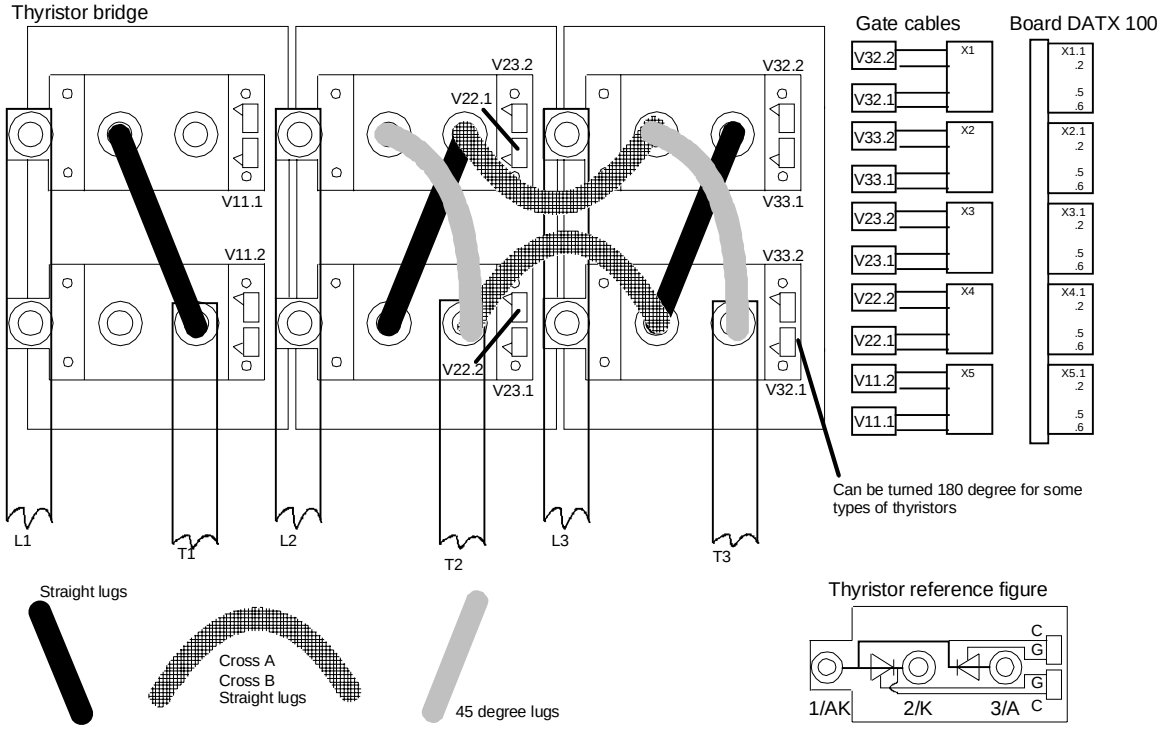
Measurement 2

Loosen the Crosses A and B, but restore the bolts and washers.

Measure the resistances between: L2–T2, T2–L2, L3–T3, T3–L3. All values must be ≥ 100 Ω.

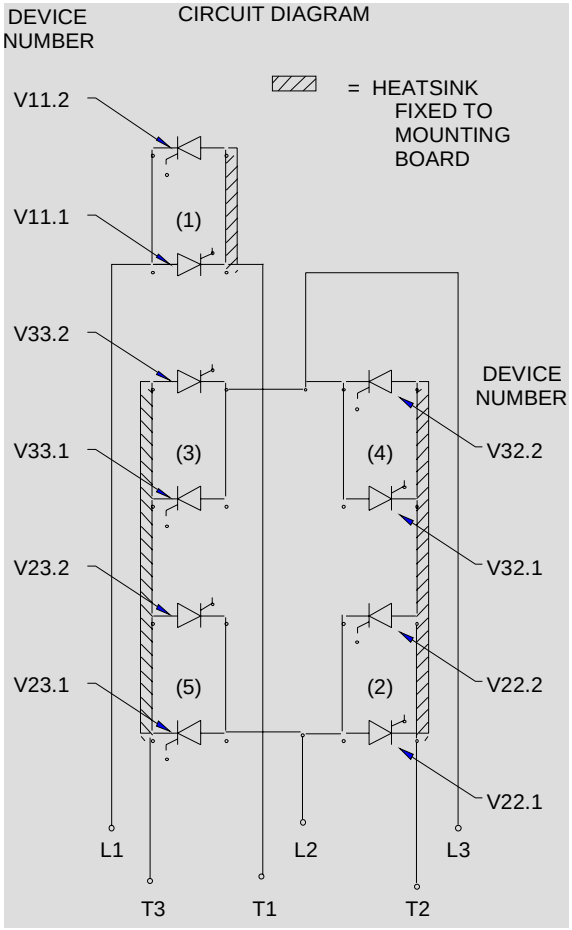
Check by successive disconnection of the flexible connectors in which of the thyristors the fault is present. Re place that thyristor.

When loosening bolts and washers we recommend restoring them in the original thread holes at once, since they otherwise can be mixed, and the connections will be erroneous and the devices may be destroyed.



9.7.2.3. Size 630 - 1100 A

Phased out types DASD 106, 107, 108, 116, 117



1) Measure the resistances between: L1–T1, T1–L1. All values must be ≥ 100 Ω.

1.1) If the result is acceptable, continue with step 2).

1.2) If the result of the resistance measurement is not acceptable the front cooler of the devices V11.2 and V11.1 shall be dismounted and these devices checked. Check, and replace if needed. The right mounting torque for the devices is obtained with the tell tale washers installed.

2) Measure the resistances between: L3–T3, T3–L3, L3–T2, T2–L3. All values must be ≥ 100 Ω.

2.1) If the result is acceptable, continue with step 3).

2.2) If the result of the resistance measurement is not acceptable remove the Cross-B. Measure the resistances between: L3–T2, T2–L3. All values must be ≥ 100 Ω.

2.2.1) If the result of the resistance measurement is not acceptable, the front cooler of the devices V32.2 and V32.1 shall be dismounted and these devices checked. Check, and replace if needed. Restore Cross B. The right mounting torque for the devices is obtained with the tell tale washers installed.

2.2.2) If the result of the resistance measurement is acceptable do not yet restore Cross B. Measure the resistance between: L3´–T3, T3–L3´, there L3´ is the left front cooler to which Cross-B is mounted. All values must be ≥ 100 Ω.

2.2.2.1) If the result of the resistance measurement is not acceptable, the front cooler of the devices V33.2 and V33.1 shall be dismounted and these devices checked. Check, and replace if needed. Restore Cross B. The right mounting torque for the devices is obtained with the tell tale washers installed.

2.2.2.2) If the result of the resistance measurement is acceptable, Restore Cross B, go back to step 2), as the result is not fully understandable.

3) Measure the resistances between: L2–T3, T3–L2, L2–T2, T2–L2. All values must be ≥ 100 Ω.

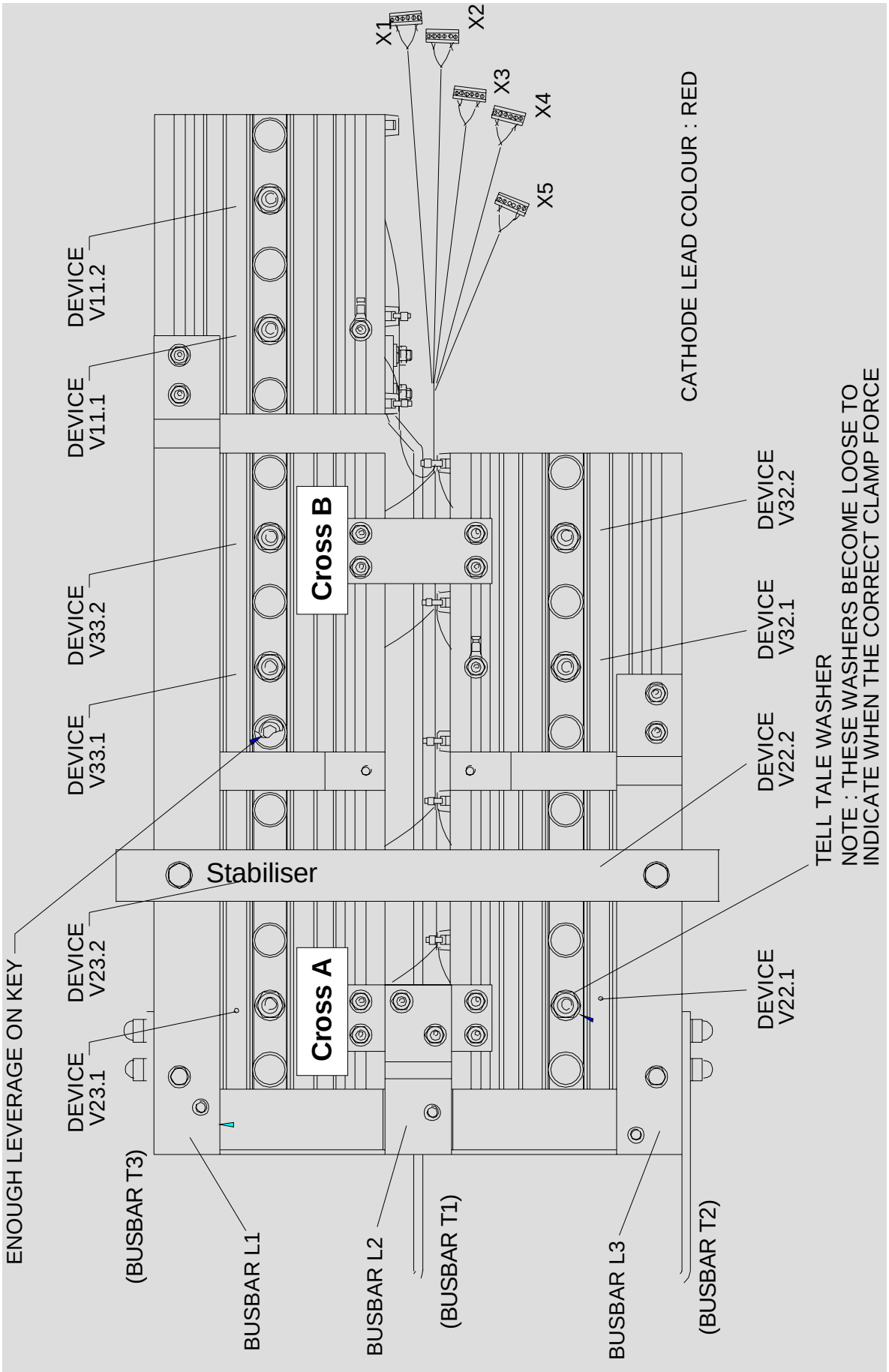
3.1) If the result of the resistance measurement is not acceptable remove the Cross A. Measure the resistance between: L2´´–T2, T2–L2´´, there L2´´ is the right front cooler to which Cross A is mounted. All values must be ≥ 100 Ω.

3.1.1) If the result of the resistance measurement is not acceptable, the front cooler of the devices V22.2 and V22.1 shall be dismounted together with the Stabiliser and these devices checked. Check, and replace if needed. Restore Cross A and the Stabiliser. The right mounting torque for the devices is obtained with the tell tale washers installed.

3.1.2) If the result of the resistance measurement is acceptable do not yet restore Cross A nor the Stabiliser. Measure the resistances between: L2´–T3, T3–L2´, there L2´ is the left front cooler to which Cross A is mounted. All values must be ≥ 100 Ω.

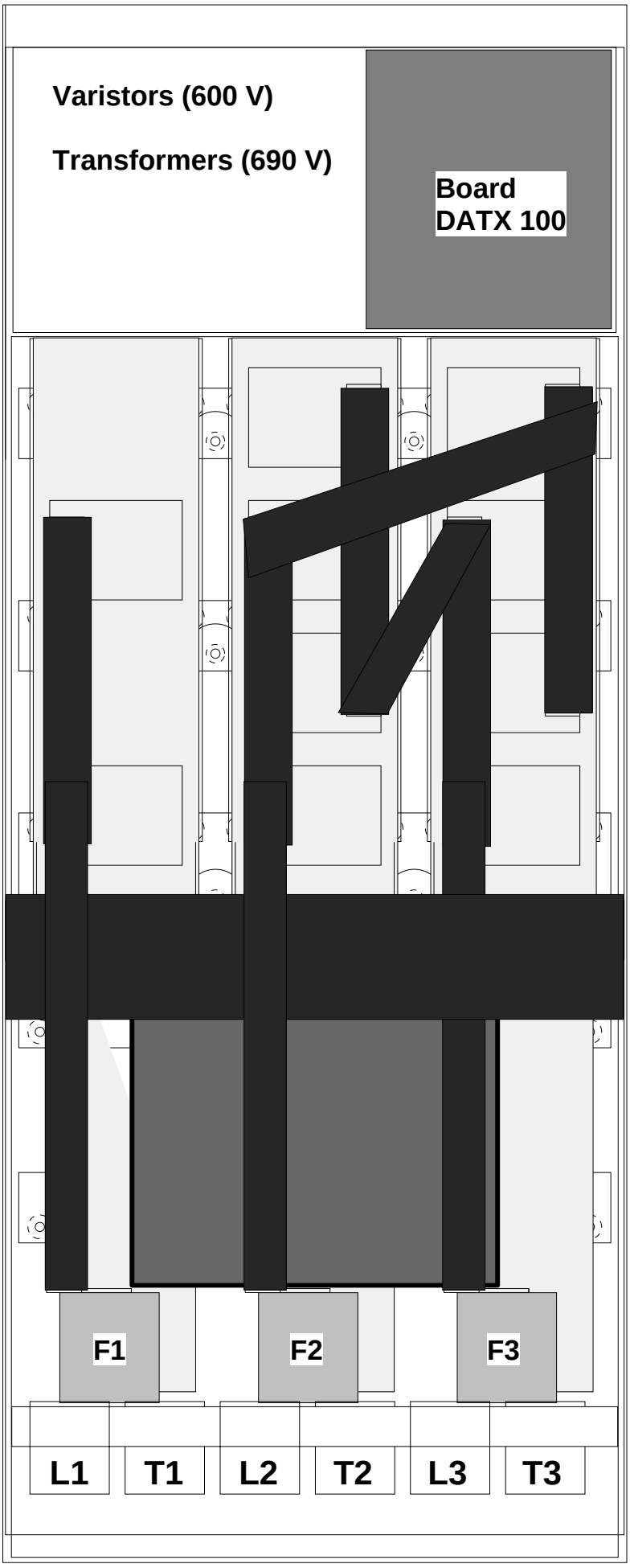
3.1.2.1) If the result of the resistance measurement is not acceptable the front cooler of the devices V23.2 and V23.1 shall be dismounted and these devices checked. Check, and replace if needed. Restore Cross A and the Stabiliser. The right mounting torque for the devices is obtained with the tell tale washers installed.

3.1.2.2) If the result of the resistance measurement is acceptable, Restore Cross A and the Stabiliser, go back to step 3), as the result is not fully understandable.



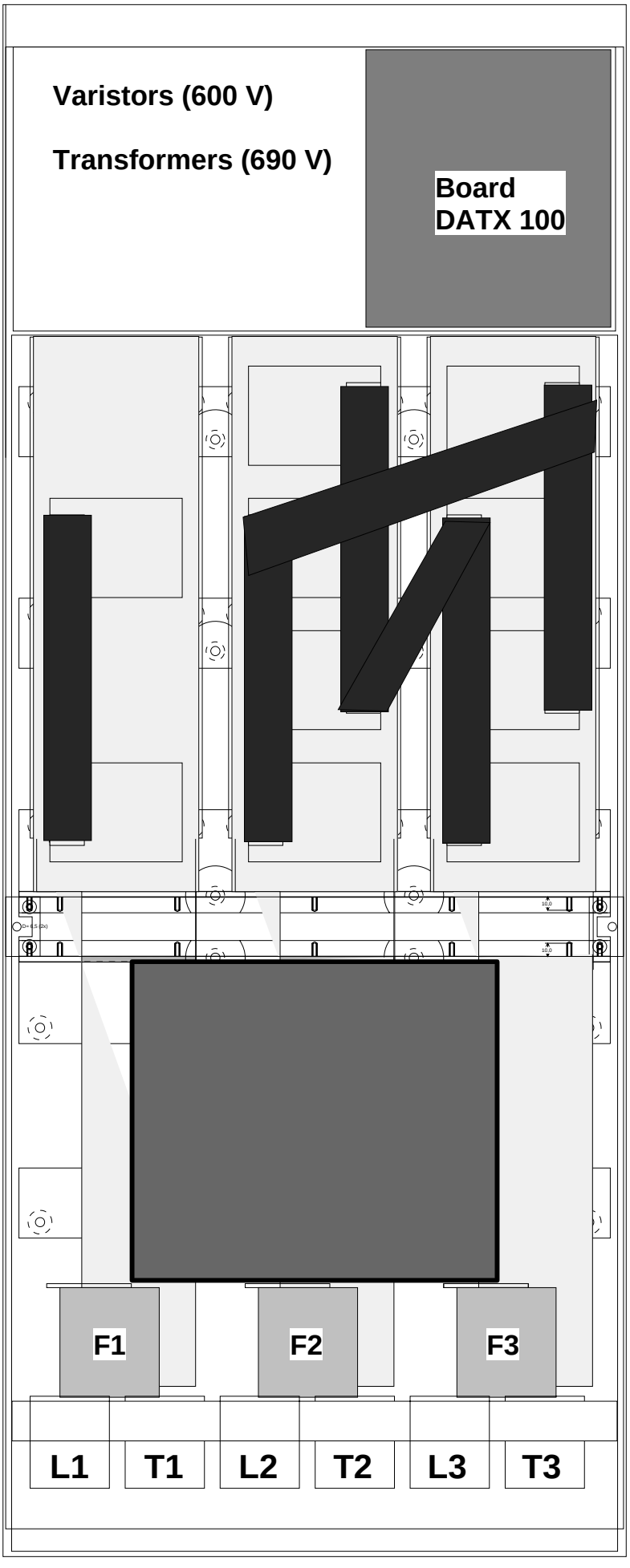
New types DASD 146, 147, 156, 157

See following pages



Instructions for how to replace fuses, varistors and circuit board.

1) Disconnect the main supply and the fan supply to the DASD module, and prevent unexpected reconnection.
2) Remove the cover from the DASD module.
3) Fuses, varistors and circuit board can be replaced.

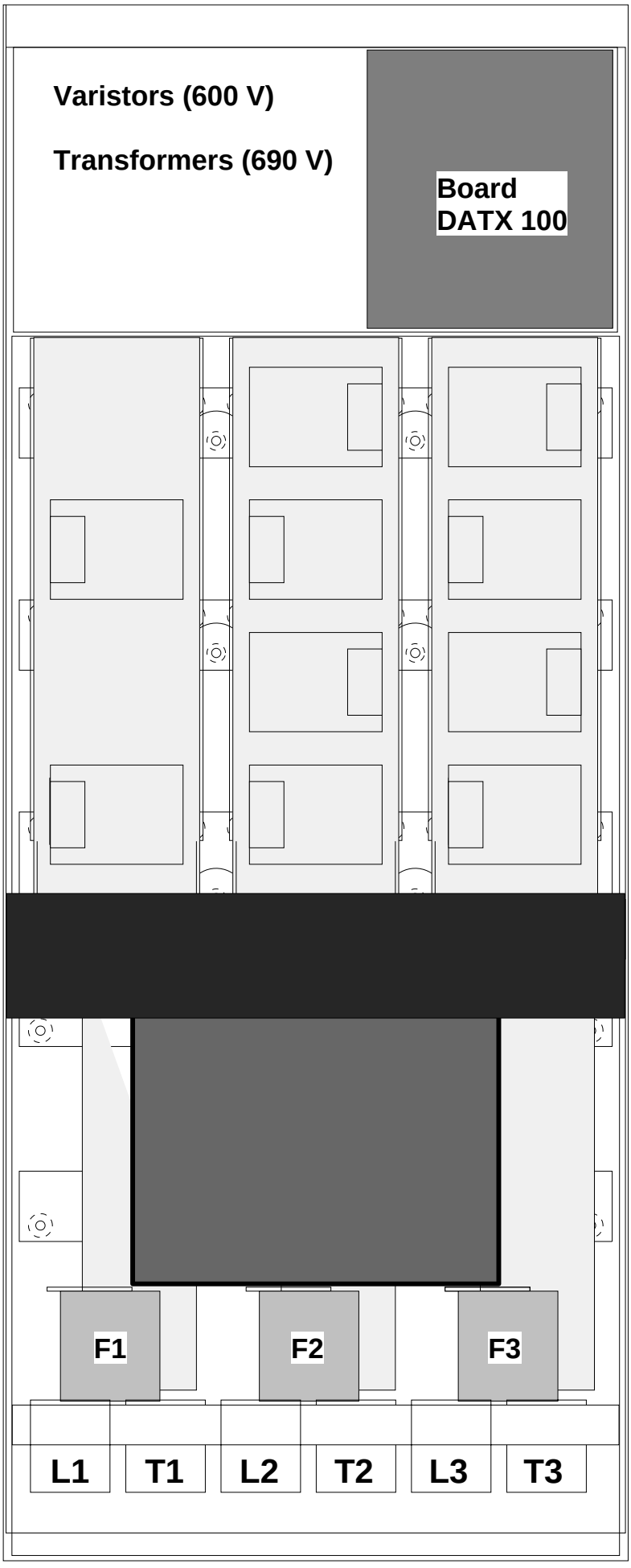


Instructions for how to replace the fan

1) Disconnect the main supply and the fan supply to the DASD module, and prevent unexpected reconnection.
2) Remove the cover from the DASD module.
3) Remove totally 6 pcs. of M8 and 3 pcs. of M12 screws with spring and plain washers so the interconnection bars from fuse-holders to Al-cooling element extension flags are disconnected, although still physically fixed.
4) Disconnect the inside Grey-Blue-Green&Yellow terminal plug to the fan unit.
5) Remove totally 6 pcs. of M6 screws that hold the horizontal metal stabiliser. Remove the stabiliser, together with the interconnection bars from fuse-holders to Al-cooling element extension flags.

The sketch shows this situation

6) Take out the air supply unit by pulling the fan straight out.
7) Trouble shoot the unit. Replace fan or capacitor. When replacing the fan, replace always the capacitor at the same time.
8) Test the air supply unit.
9) Reinstall the air supply unit by doing the above listed measures in the opposite order.



Instructions for how to check thyristors

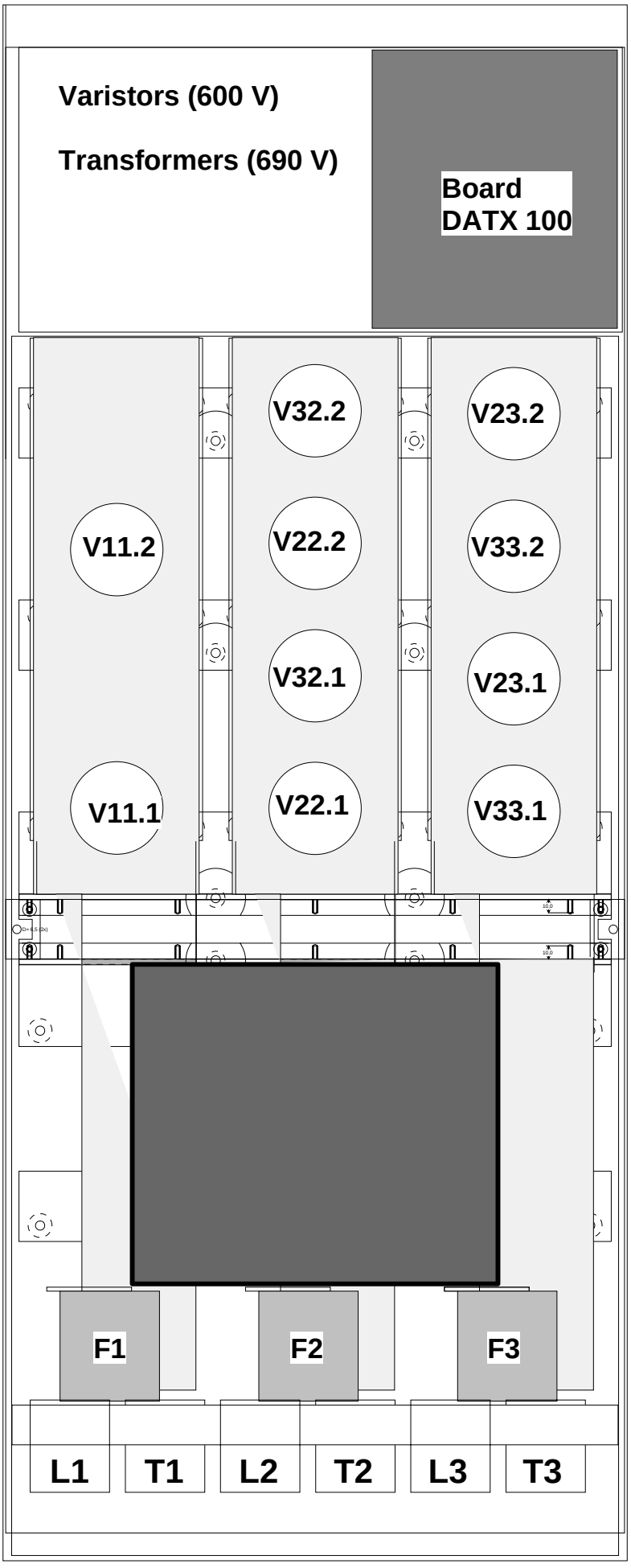
1) Disconnect the main supply and the fan supply to the DASD module, and prevent unexpected reconnection.
2) Remove the cover from the DASD module.
3) Remove bus bars to main fuses, and interconnection bus bars in the stack.
4) All potentials of the thyristors are available without loosening any pressure clamp

The sketch shows this situation

Circuit diagram, see Reference section

5) Check the thyristors acc. to the circuit diagram.

5) Restore

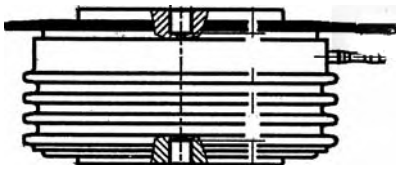


Mounting position of each thyristor device.

Devices with index **.1**:
Mounted with the Cathode side to the fixed 125 mm wide cooler.

Devices with index **.2**:
Mounted with the Anode side to the fixed 125 mm wide cooler.

Cathode side



Anode side

Circuit diagram, see Reference section

Check the thyristors acc. to the circuit diagram.

Following clamping forces shall be used:
DASD 146 and DASD 156: 12 kN. Turn until position 3 (of 4) of the position indicator is reached.

DASD 147 and DASD 157: 22 kN. Turn until the position indicator is reached.

10. Spare parts list

Modules and items that are no longer delivered in new equipment but available as spare parts only are marked with Grey shading: Old part

Category	Type	Description	Identity	Used where
Circuit boards	DAPC 100	Control board	3ASC25H203	DARA 1000, 1000+AO, 1001, 1010, 1010+AO
	DAPU 100	I/O Control board	3ASC25H204	DARA 1000, 1001, DAPM 100, DAPM 101 (Som reservdel)
	DATX 100	Pulse transformer board	3ASC25H208	DASD 0xx, 1xx
	DATX 110	I/O board, No AO, Control Module	3ASC25H209	DARA 1000, 1001, 1010
	DATX 110+AO+PU	I/O board, with I/O Control board 2 AO, Control Module	3ASC25H209+AO +PU	DARA 1000, 1001, 1010
	DATX 111	I/O board No AO, Supervision system	3ASC25H224	DARA 2000
	DATX 111+AO	I/O board 2 AO, Supervision system	3ASC25H224+AO	DARA 2000
	DATX 120	I/O board Remote I/O DI+DO+AI+AO	3ASC25H210	DAPM 100
	DATX 121	I/O board Remote DI+DO+AI	3ASC25H218	DAPM 101
	DATX 130	Rotor feedback board	3ASC25H214	DARA 1001, 1010
	DATX 132	Torque observer board	3ASC25H216	DARA 1001
	DATX 133	Pulse repeater board	3ASC25H219	DARA 1010
Thyristors[21]	Thyristor Module		3ASC485811H11	DASD 001 ... 103 (5x)
	Thyristor Module		3ASC485812H11	DASD 104 and 105 (6x)
	Thyristor Module		3ASC485813H11	DASD 151..155 (5x)/(6x)
	Thyristor Module		3ASC485814F1	DASD 145 (5x)
	Thyristor		3ASC485506E19	DASD 146 (10x)
	Thyristor		3ASC485506E23	DASD 156 (10x)
	Thyristor		3ASC485514E19	DASD 147 (10x)
	Thyristor		3ASC485514E23	DASD 157 (10x)
	Thyristor		3ASC485506E17	DASD 106 (10x).
	Thyristor		3ASC485506E13	DASD 126 (10x).
	Thyristor		3ASC485514E17	DASD 107 (10x).
	Thyristor		3ASC485514E13	DASD 108, 127 (10x).
Fans	Ziehl ebm W2S 142-BB 05-01	Compact fan 115 VAC, 330 m^3/h, 172 mm	3ASC648020H1	DASD 102, 103 (1x) DASD 104 .. 107 (2x)
Replaced with3ASC648030A1	Ziehl ebm Papst 8314 HLR	Compact fan 24 VDC, 60 m^3/h, 80 mm	3ASC648030A1	DASD 002 (1x), DASD 003 (2x)
	Ziehl ebm Papst 8124 K	Compact fan 24 VDC, 60 m^3/h, 80 mm	3ASC648040A1	DASD 002 (1x), DASD 003 (2x)
	Ziehl ebm D4E133-ASTAT	Radial fan 220-230 VAC, 760 m^3/h	3ASC648050E1	DASD 146, DASD 156 (1x)
	Ziehl ebm D4E160-ASTAT	Radial fan 220-230 VAC, 1310 m^3/h	3ASC648051E1	DASD 147, DASD 157 (1x)
	DAFU 145	Fan unit for DASD 145 including D4E160-ASTAT	3ASC25H229	DASD 145 (1x)

[21] The thyristors listed here are always suitable as spare. The installed thyristors are not always the same. Always change both devices that are fixed with a common cooler in DASD 10x and DASD 12x!

Category	Type	Description	Identity	Used where
Fuses	SIBA / Gould	2 A FF, 6 ∗ 32 mm, 600 700V	3ASC567201H12 3ASC567201H23	DASD 001 .. 105 (6x) (3x) DASD 145, 146,147 (3x) DASD 151 .. 157 (3x) DASG 222, DASG 223 (3x)
	SIBA	10 A , 6 ∗ 32 mm, 600V	FAR7009463 302-8800	DASD 106, 107, 126, 127 , 001, 002, 003, 101, 102, 103, 104, 105, 145, 146, 147 (3x)
	BUSSMAN	10 A F, 10,3 ∗ 38 mm, 600 V	3BSC770010R301	DASG 218, DASG 219, DASG 220, DASG 221, DASG 118, DASG 119, DASG 121 (3x)
	HRC-fuse	25 A, 10,3 ∗ 38 mm, 690 V	RS314-4838	DASD 222, DASG 223 (3x)
From 2007	Fast fuse link	690 V AC, 900 A	G3MÜF02/900A/690V	DASD 146 (3x)
To 2007	BUSSMAN 3BKN/80 170M6546	80 mm 1000 V AC, 800 A	3ASC567501H10	DASD 106, 126, 146, 156 (3x)
From 2007	Fast fuse link	690 V AC, 1250 A	G3MÜF02/1250A/690V	DASD 147 (3x)
To 2007	BUSSMAN 3BKN/80 170M6549	80 mm 1000 V AC, 1100 A	3ASC567501H16	DASD 107, 108, 127, 147, 157 (3x)
Cables	-	Firing Pulse cable, 2 m	3ASC262721H20	All ASTAT with DASD 1xx
	-	Firing Pulse cable 3 m	3ASC262721H30	ASTAT with Double Bridges
	-	Firing Pulse cable 0,7 m	3ASC262721H7	DARA 1001, 1010, DASD 0xx
Overvoltage protection	Crouzet FW 3 x 400 V	Phase failure and sequence monitor	3ASC742401J12	DASG 118
	Crouzet FW 3 x 480 V	Phase failure and sequence monitor	3ASC742401J15	DASG 119
	Crouzet FW 3 x 575 V	Phase failure and sequence monitor	3ASC742401J16	DASG 221, DASG 121
	BC9-30-10, 240 V	DC-contactor	FPL 141 3001 R3103	DASG 118, DASG 119, DASG 121, DASG 218, DASG 219, DASG 220, DASG 221
	A9-30-10, 380 - 400 V AC	AC-contactor	1SBL141001R8510	DASG 218 (2x)
	A9-30-10, 415 V AC	AC-contactor	1SBL141001R8610	DASG 219 (2x)
	A9-30-10, - 440 V / 50 Hz - 500 V / 60 Hz	AC-contactor	1SBL141001R5310	DASG 220 (2x)
	Semikron: SKD 31/16	Diode bridge	3ASC485821H1	DASG 218, DASG 219, DASG 220, DASG 118, DASG 119
	Semikron: SKKD 81/20	Diode module	3ASC485822H1	DASG 221 (3x), DASG 121 (3x)
	PaM 63-8,0	Capacitor, 8 μF, 630 VAC	4984 229-9	DASG 218 (1x), DASG 219 (1x), DASG 220 (xx), DASG 118 (1x), DASG 119 (2x)
	PaM 85-4,0	Capacitor, 8 μF, 850 VAC	4984 220-9	DASG 221 (2x) DASG 121 (3x)
RC-modules are replaced by varistors since 2004-2005	DASG 110	RC module, 530V	3ASC25H297	DASD 101, 102, 103, 104, 105
	DASG 111	RC module, 600V	3ASC25H295	DASD 106, 107, 126, 127
Power supply	DASA 110	Power supply module	3ASC25H271	DARA 1000, 1001, 1010
Indication	DATD 100	Termination board, Cabin I/O	3ASC25H207	DAPM 100, 101
Hoist Safety	DATD 111	Safety Relay board	3ASC25H213B	DARA 2000

11. Installation diagram forms

The circuit diagram forms are developed to serve as a tool for the electrical designer. The forms are available in printed form in this manual and as dxf-files on the ASTAT Tools CD.

11.1. Thyristor Modules

Select one of the forms of Section Thyristor Modules:

25 A Thyristor Module, DASD 001 and DASD 101: {see page 226}.
dxf-file: 200-2.1.dxf

50, 100 A Thyristor Module, DASD 102 and DASD 103 (Large type): {see page 227}.
dxf-file: 200-2.2.dxf

50 A Thyristor Module, DASD 002 (Compact type): {see page 228}.
dxf-file: 200-2.2A.dxf

100 A Thyristor Module, DASD 003 (Compact type): {see page 229}.
dxf-file: 200-2.2B.dxf

200, 355 A Thyristor Module: {see page 230}.
dxf-file: 200-2.3.dxf

Parallel 200, 355 A Thyristor Modules: {see page 231}.
dxf-file: 200-2.4.dxf

630, 1000, and 1100 A Thyristor Module: {see page 232}.
dxf-file: 200-2.5.dxf

Parallel 630, 1000, 1100 A Thyristor Modules: {see page 233}.
dxf-file: 200-2.6.dxf

11.2. Control System

Select one of the Control Systems DARA 1000 DARA 1001, DARA 1010 and the common I/O forms.

11.2.1. Control System

11.2.1.1. DARA 1000

Basic Control System Module: {see page 234}. dxf-file: 200-1.1#.dxf

11.2.1.2. DARA 1001, 1010

Extended Control System Module: {see page 235}. dxf-file: 200-1.2#.dxf

11.2.2. I/O of DARA 1000, 1001 or 1010

For both DARA 1000 and DARA 1001 (6 sheets) {see page 236 to 241}
dxf-files: 200-3.dxf, 200-4.dxf, 200-5.dxf, 200-6.dxf, 200-7.dxf, and 200-8.dxf

11.2.3. Rotor measurement

For DARA 1001, 1010 (1 sheets) {see page 242}. dxf-file: 200-9.dxf

11.3. Cabin I/O

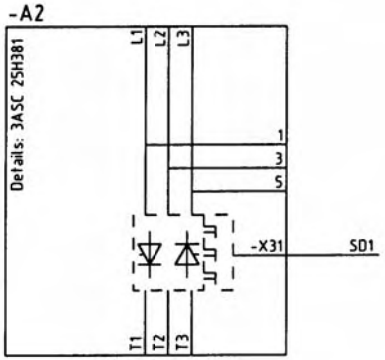
Select one of the Cabin I/O alternatives, if remote one, two or three I/O will be installed. For two I/O use two forms, for three I/O use three forms.
The form is valid for DAPM 100 as well as DAPM 101.
Form: {see page 243}. dxf-file: 200-10A.dxf

11.4. Overvoltage protection

Form: {see page 244}. dxf-file: 200-12.dxf

11.5. Multi-drop communication

Form: {see page 245}. dxf-file: 200-13#.dxf



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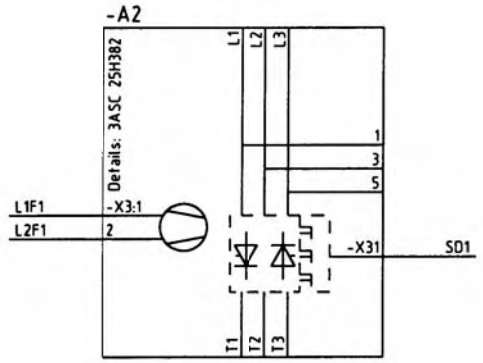
ELCAD ID /25h200.pro/-8 Standard/H200/2.1 Date 1999-10-06 Time 13:19

		Prepared	1999-06-21	L.T.HANSSON/MS	SINGLE BRIDGE 25A
		Approved	1999-06-21	L.T.HANSSON	
Rev Ind	Revision	Reg No			ABB Automation and Drives
Based on		Prl			3ASC 25H200

Resp dep ICH | Rev Ind | Lang | Sheet 2.1 | Cont 2.2



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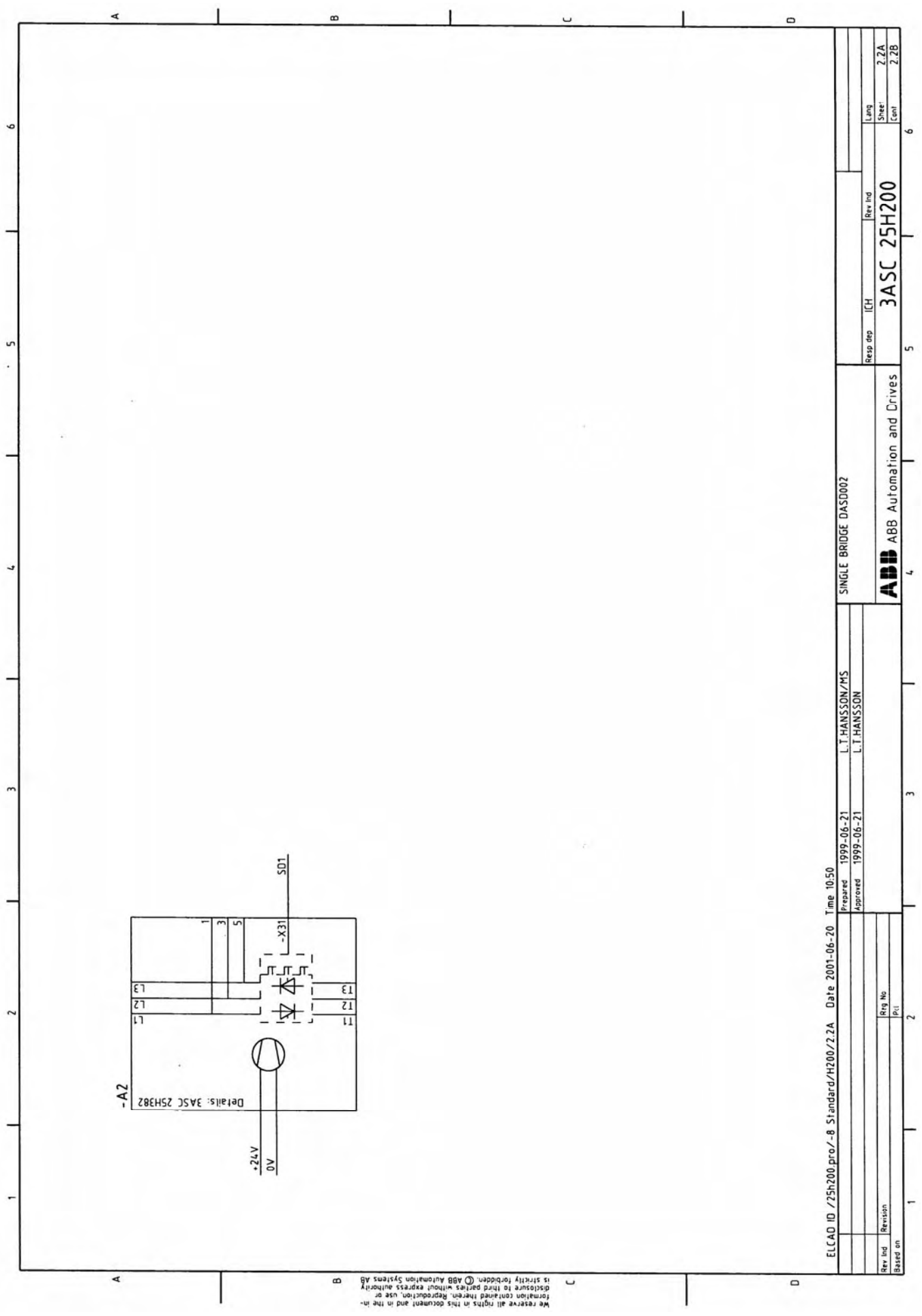
ELCAD ID /25h200.pro/-8 Standard/H200/2.2 Date 1999-10-06 Time 13:19

Prepared	1999-06-21	L.T.HANSSON/MS	SINGLE BRIDGE 50-100A		
Approved	1999-06-21	L.T.HANSSON			
Rev Ind	Revision	Reg No	ABB ABB Automation and Drives	Resp dep ICH	Rev Ind
Based on		Pcl		3ASC 25H200	Lang
					Sheet 2.2
					Cont 2.3



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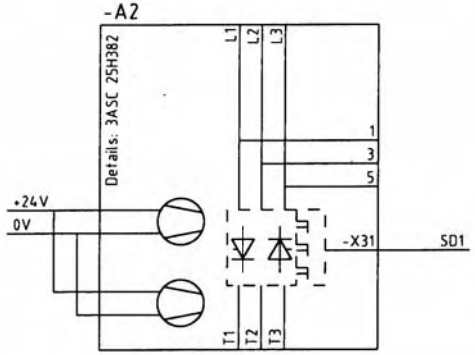

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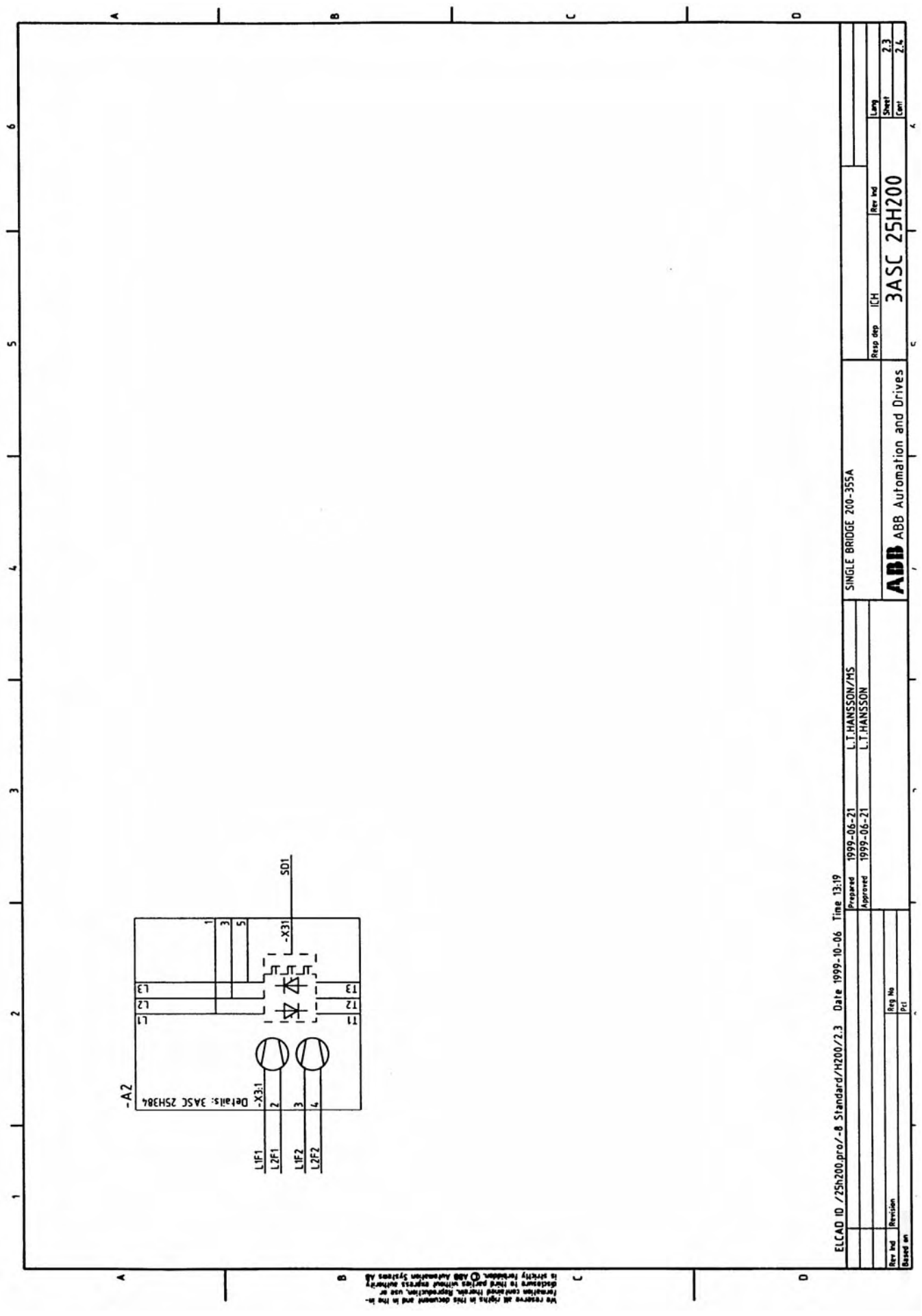
ELCAD ID /25h200.pro/-8 Standard/H200/2.2B Date 2001-06-20 Time 10:50

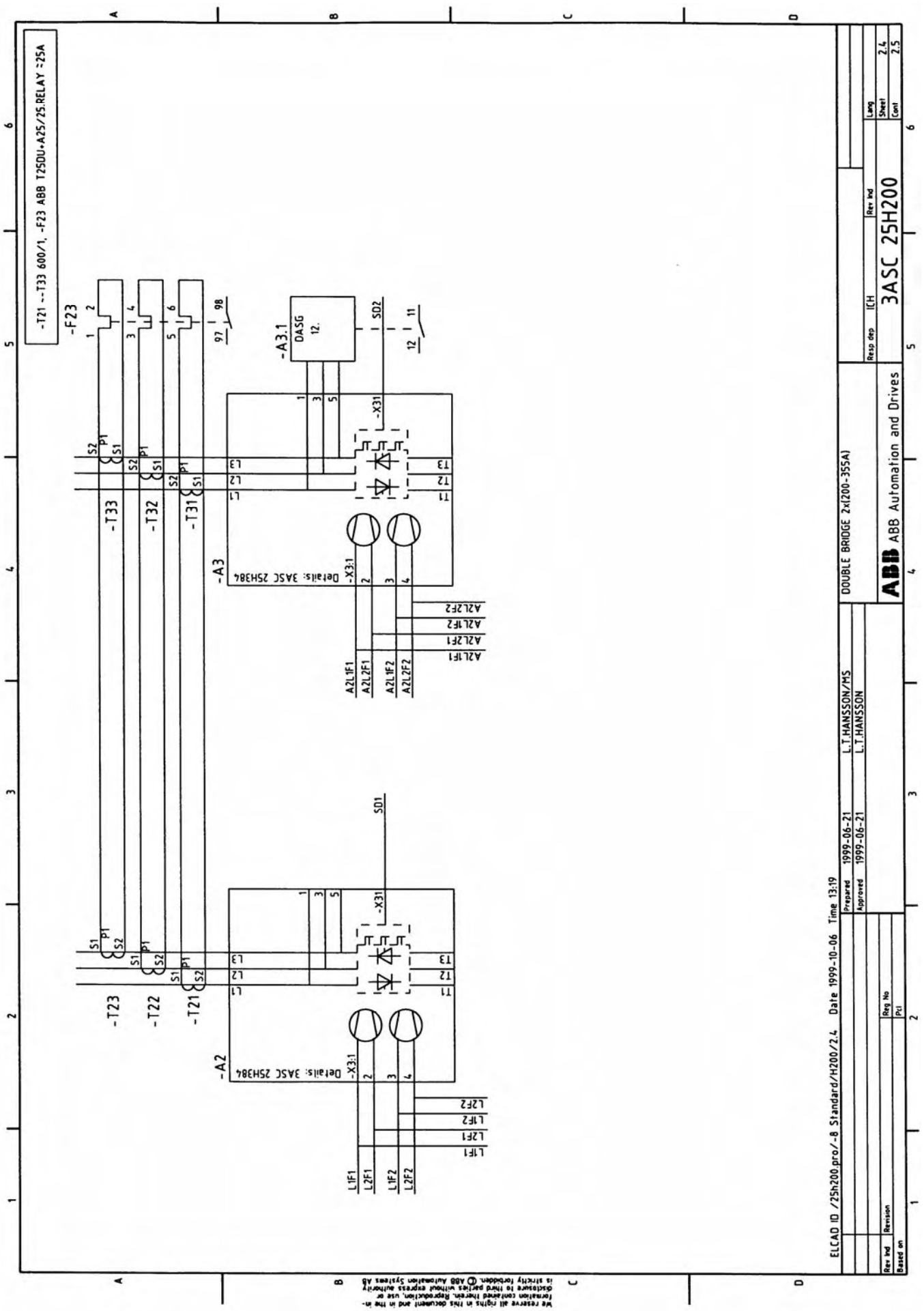
		Prepared 1999-06-21	L.T.HANSSON/MS	SINGLE BRIDGE DASD003	
		Approved 1999-06-21	L.T.HANSSON		
Rev Ind	Revision	Reg No			
Based on		Pct		ABB ABB Automation and Drives	3ASC 25H200

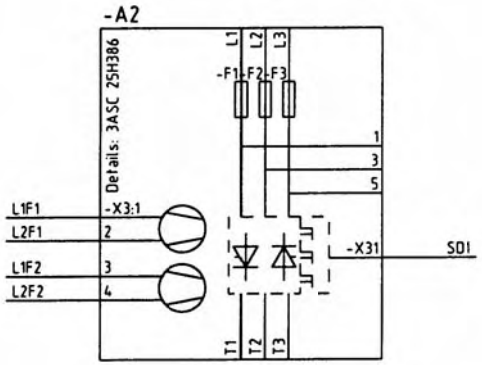
Resp dep ICH | Rev Ind | Lang

Sheet 2.2B

Cont 2.3


-A2
Details: 3ASC 25H384
-X31
SD1
L1F1
L2F1
L1F2
L2F2
ELCAD ID /25h200.pro/-8 Standard/H200/2.3 Date 1999-10-06 Time 13:19
Prepared 1999-06-21 L.T.HANSSON/MS
Approved 1999-06-21 L.T.HANSSON
SINGLE BRIDGE 200-355A
ABB Automation and Drives
3ASC 25H200
Resp dep ICH
Rev Ind
Lang
Sheet 2.3
Cont 2.4
Rev Ind
Revision
Based on
Req No
Pct


-T21 --T33 600/1, -F23 ABB T25DU+A25/25.RELAY :25A
-F23
-T33
-T32
-T31
-T23
-T22
-T21
-A3.1
DASG
12.
-A3
-A2
Details: 3ASC 25H384
-X31
-X3:1
SD1
SD2
A2L1F1
A2L2F1
A2L1F2
A2L2F2
L1F1
L2F1
L1F2
L2F2
DOUBLE BRIDGE 2x(200-355A)
ABB Automation and Drives
3ASC 25H200
ELCAD ID /25h200.pro/-8 Standard/H200/2.4 Date 1999-10-06 Time 13:19
Prepared 1999-06-21 L.T.HANSSON/MS
Approved 1999-06-21 L.T.HANSSON



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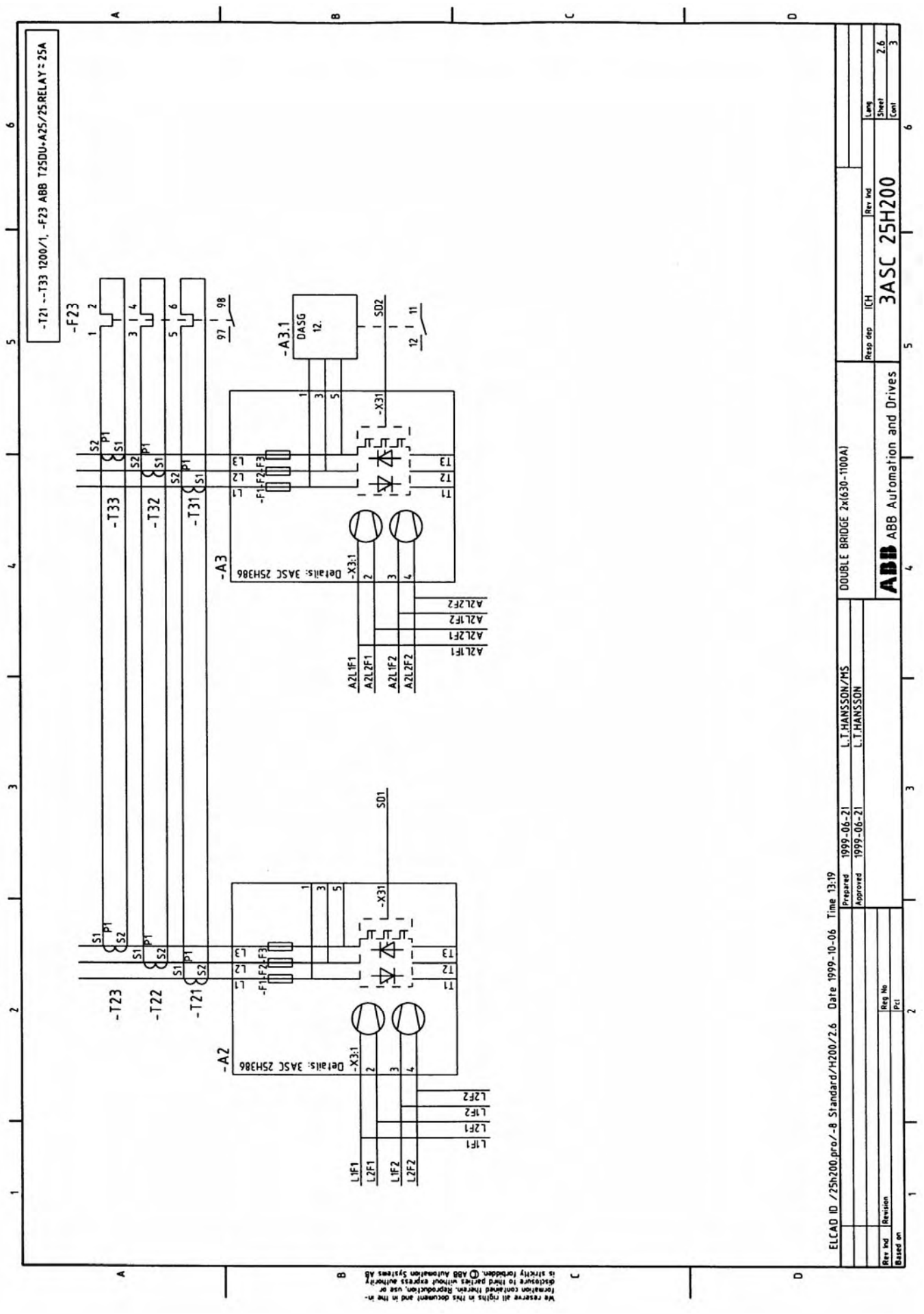
ELCAD ID /25h200.pro/-8 Standard/H200/2.5 Date 1999-10-06 Time 13:19

		Prepared	1999-06-21	L.T.HANSSON/MS	SINGLE BRIDGE 630-1100A
		Approved	1999-06-21	L.T.HANSSON	
Rev Ind	Revision		Reg No		ABB ABB Automation and Drives
Based on			Pct		

Resp dep	ICH	Rev ind	Lang
3ASC 25H200		Sheet	2.5
		Cont	2.6


-T21 --T33 1200/1, -F23 ABB T25DU+A25/25 RELAY: 25A
-F23
-T33
-T32
-T31
-T23
-T22
-T21
-A3
-A2
-A3.1
DASG
12.
Details: 3ASC 25H386
-X31
-X3:1
-F1 -F2 -F3
SD1
SD2
A2L1F1
A2L2F1
A2L1F2
A2L2F2
A2L1F
A2L2F1
A2L1F2
A2L2F2
L1F1
L2F1
L1F2
L2F2
L1F
L2F1
L1F2
L2F2
DOUBLE BRIDGE 2x(630-1100A)
ABB ABB Automation and Drives
3ASC 25H200
ELCAD ID /25h200.pro/-8 Standard/H200/2.6 Date 1999-10-06 Time 13:19
Prepared 1999-06-21 L.T.HANSSON/MS
Approved 1999-06-21 L.T.HANSSON
Rev Ind Revision
Based on
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Pct
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Rev Ind
Lang
Sheet 2.6
Cont 3
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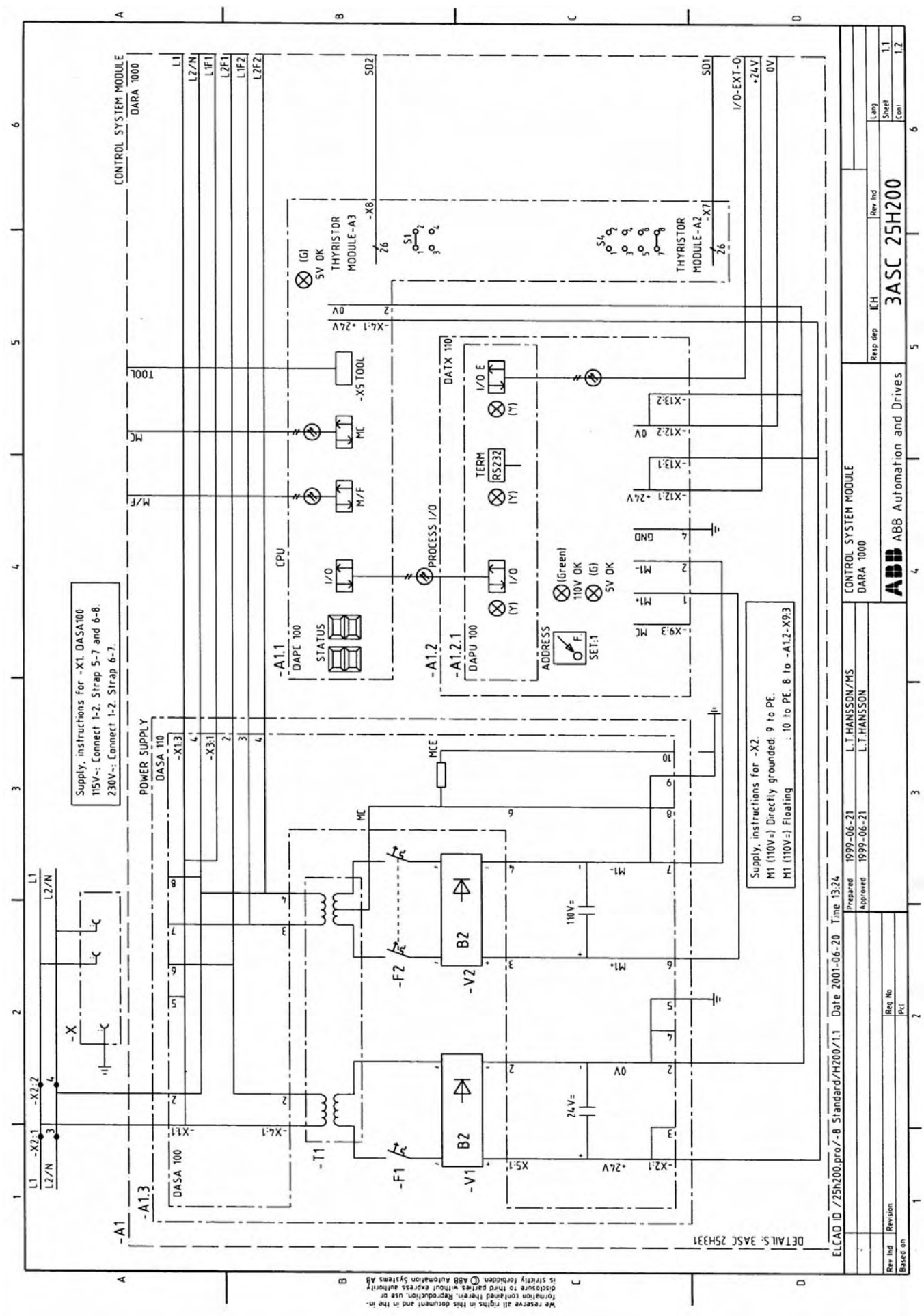
CONTROL SYSTEM MODULE
DARA 1000
POWER SUPPLY
DASA 110
DASA 100
-A1
-A1.3
-A1.1
DAPC 100
CPU
-A1.2
-A1.2.1
DAPU 100
DATX 110
THYRISTOR
MODULE-A3
THYRISTOR
MODULE-A2
-X8
-X7
-X5 TOOL
-X
-T1
-F1
-F2
-V1
-V2
B2
MCE
MC
M/F
TOOL
PROCESS I/O
I/O
I/O E
TERM
RS232
STATUS
ADDRESS
SET:1
(G)
5V OK
(Green)
110V OK
(Y)
110V=
24V=
+24V
0V
GND
I/O-EXT-0
Supply, instructions for -X1. DASA100
115V~: Connect 1-2. Strap 5-7 and 6-8.
230V~: Connect 1-2. Strap 6-7.
Supply, instructions for -X2.
M1 (110V=) Directly grounded: 9 to PE.
M1 (110V=) Floating : 10 to PE. 8 to -A1.2-X9:3
ELCAD ID /25h200.pro/-8 Standard/H200/1.1 Date 2001-06-20 Time 13:24
Prepared 1999-06-21 L.T HANSSON/MS
Approved 1999-06-21 L.T HANSSON
CONTROL SYSTEM MODULE
DARA 1000
ABB Automation and Drives
3ASC 25H200
DETAILS: 3ASC 25H331
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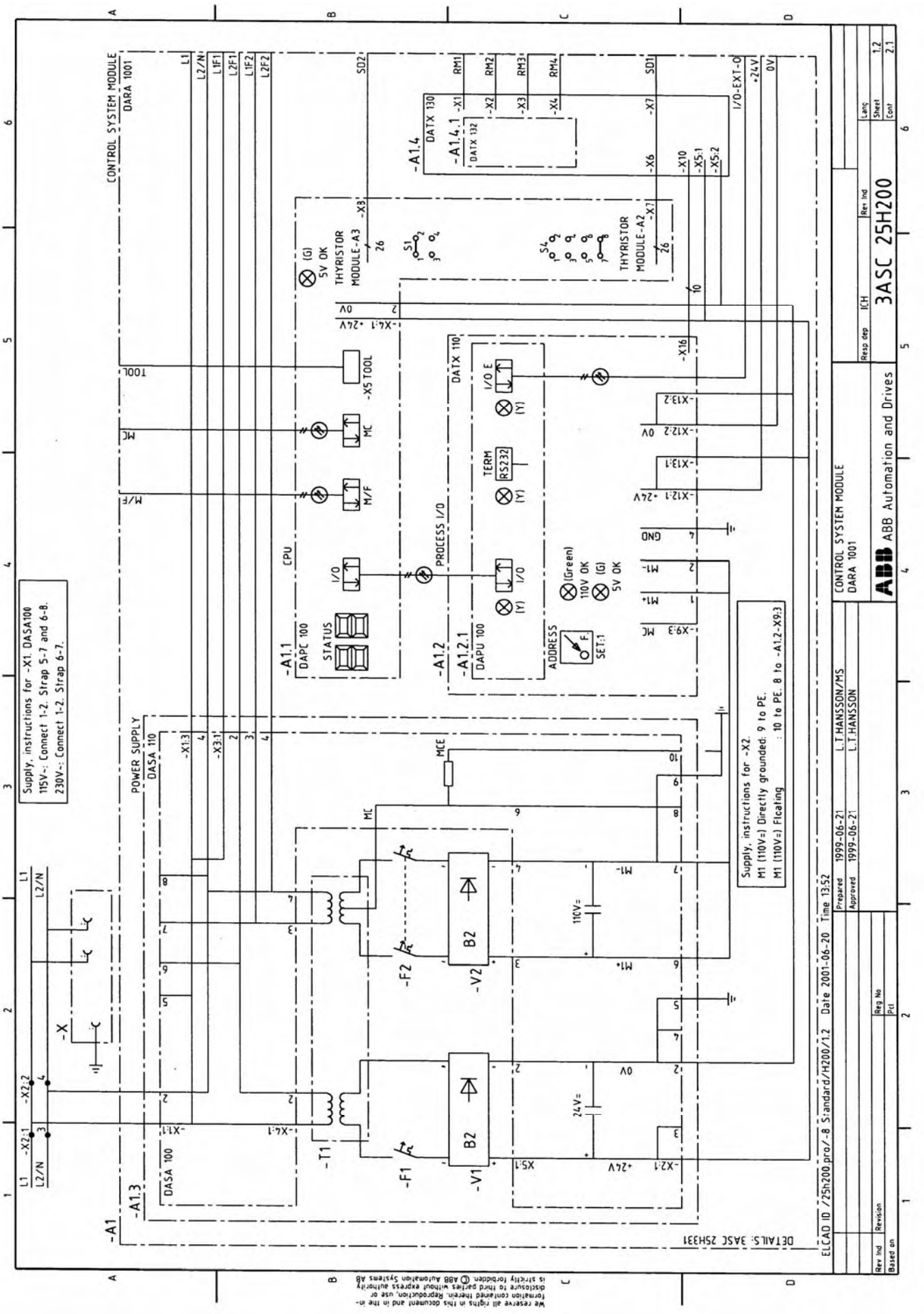

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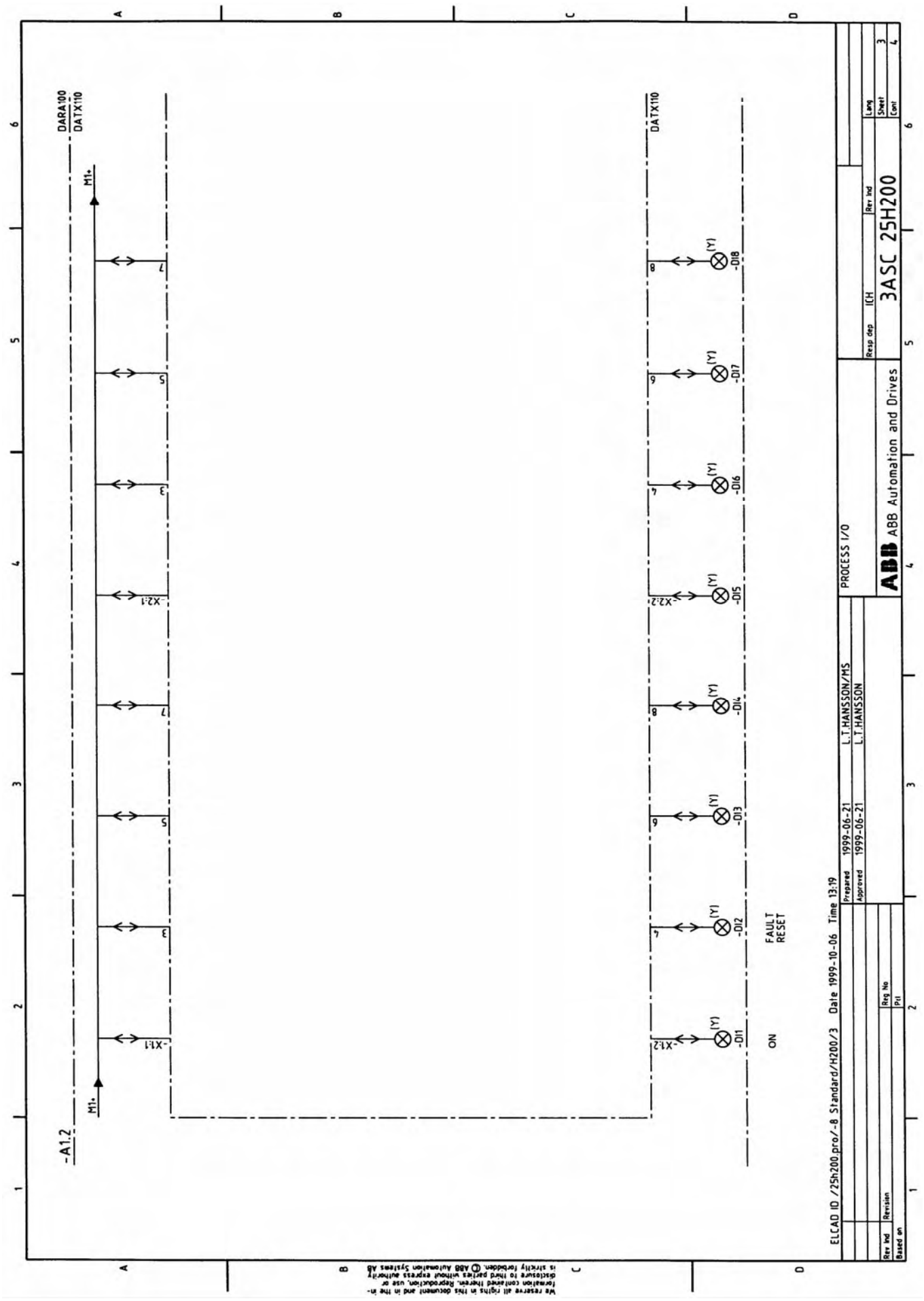
DARA100
DATX110
M1+
M1+
-A1.2
-X1:1
-X2:1
DATX110
-X1:2
-X2:2
-DI1
-DI2
-DI3
-DI4
-DI5
-DI6
-DI7
-DI8
ON
FAULT
RESET
ELCAD ID /25h200.pro/-8 Standard/H200/3 Date 1999-10-06 Time 13:19
Prepared 1999-06-21 L.T.HANSSON/MS
Approved 1999-06-21 L.T.HANSSON
PROCESS I/O
ABB Automation and Drives
Resp dep ICH
3ASC 25H200
Rev Ind
Lang
Sheet 3
Cont 4
Rev Ind Revision
Based on
Req No
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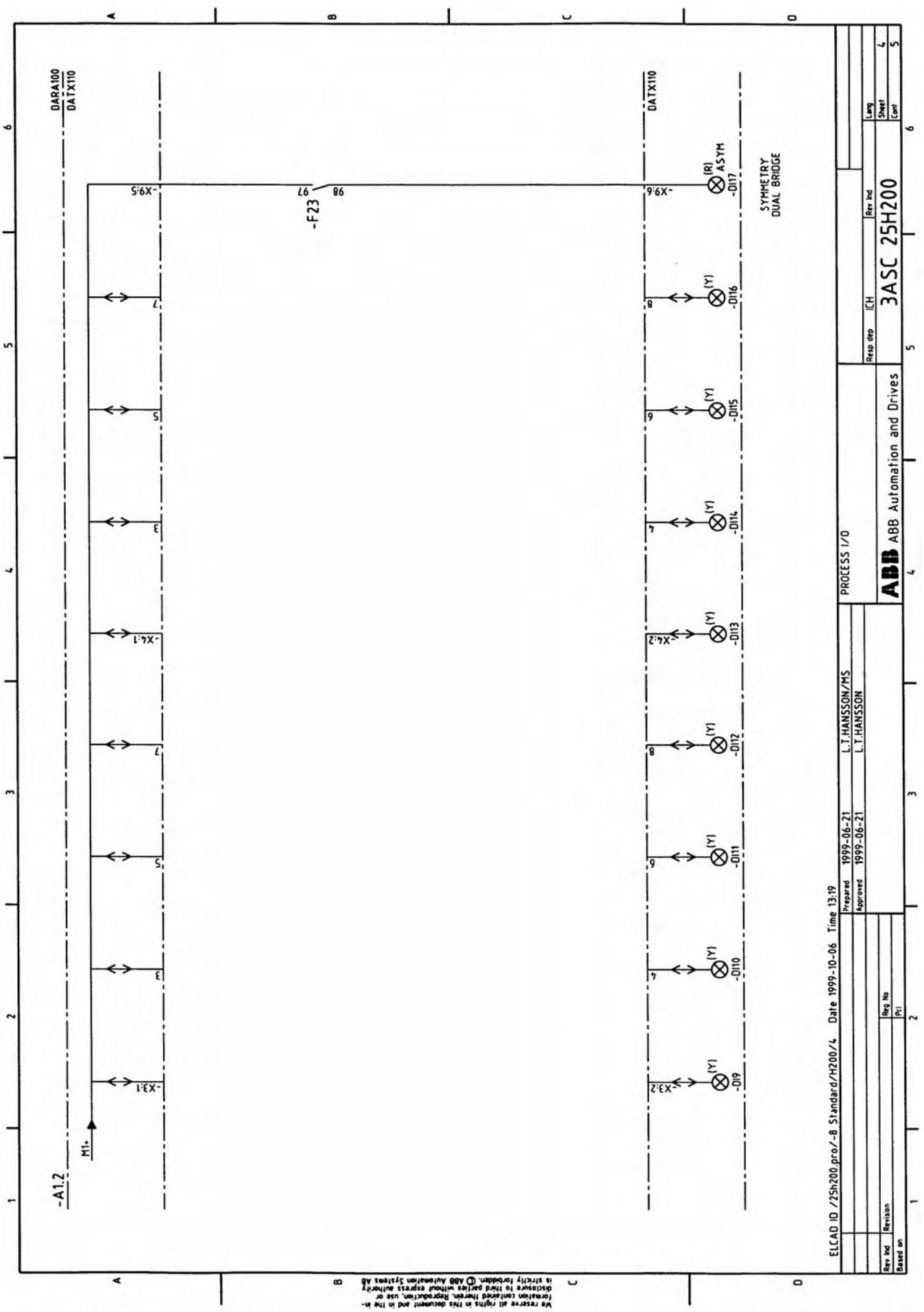

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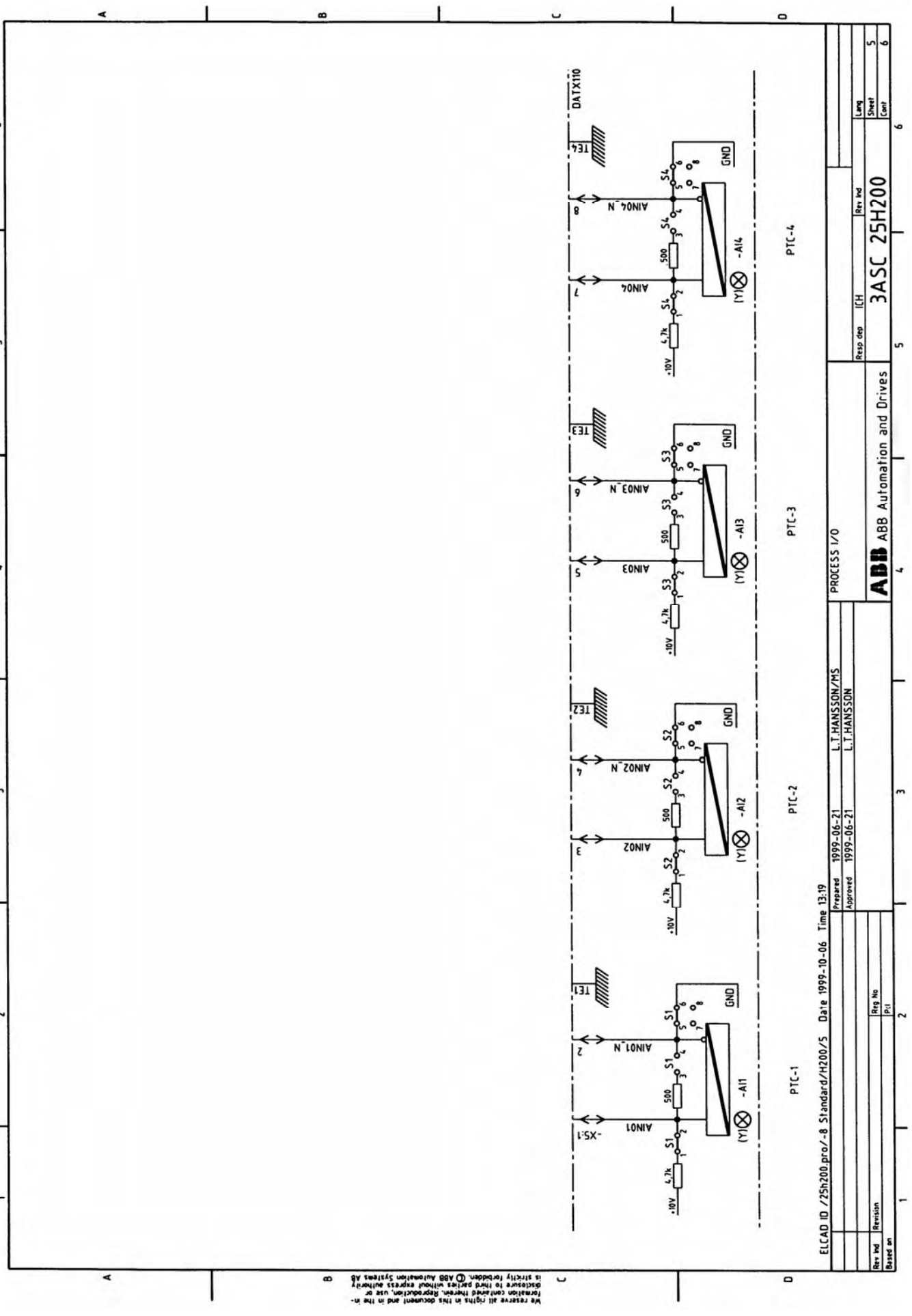

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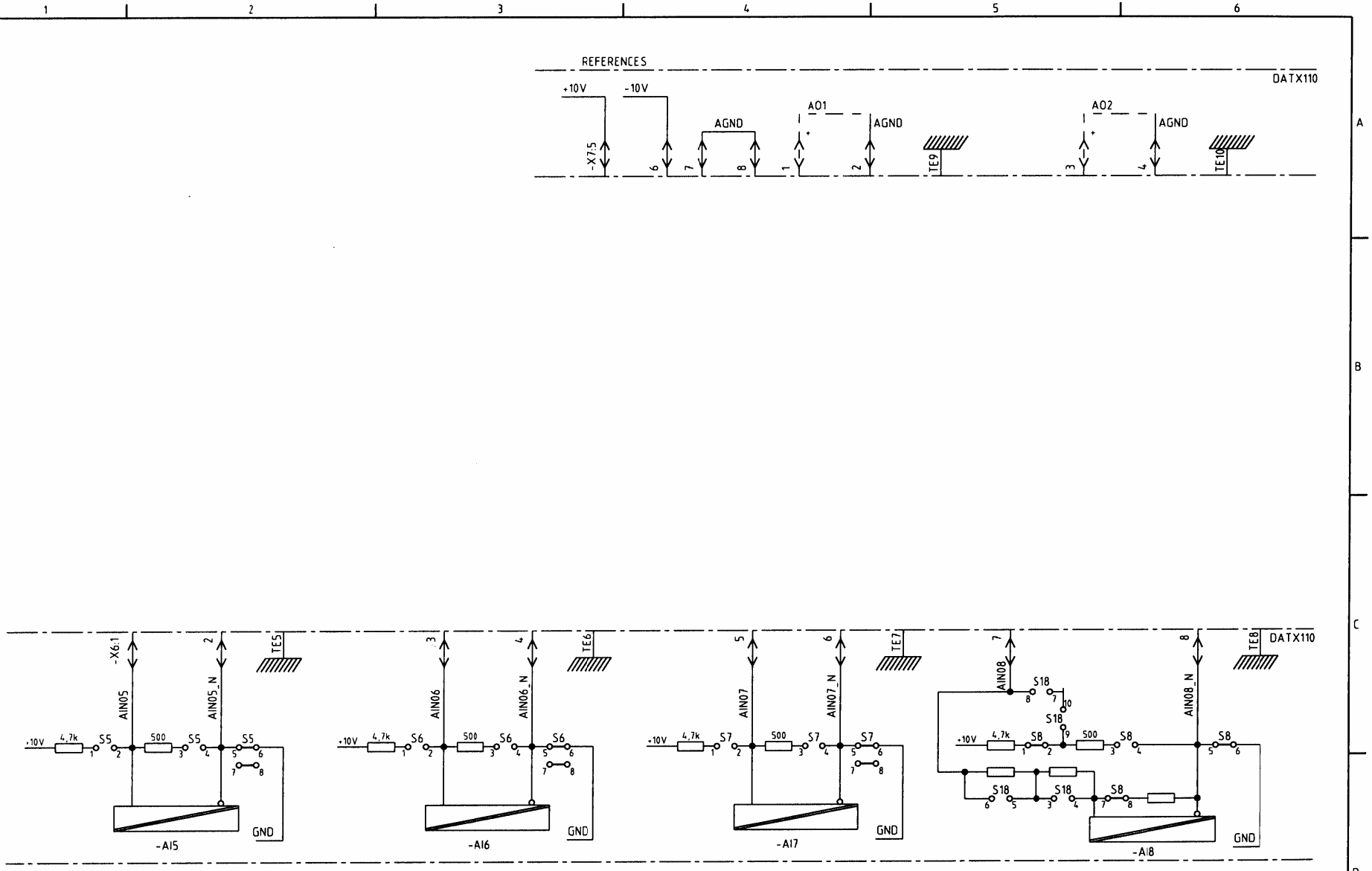
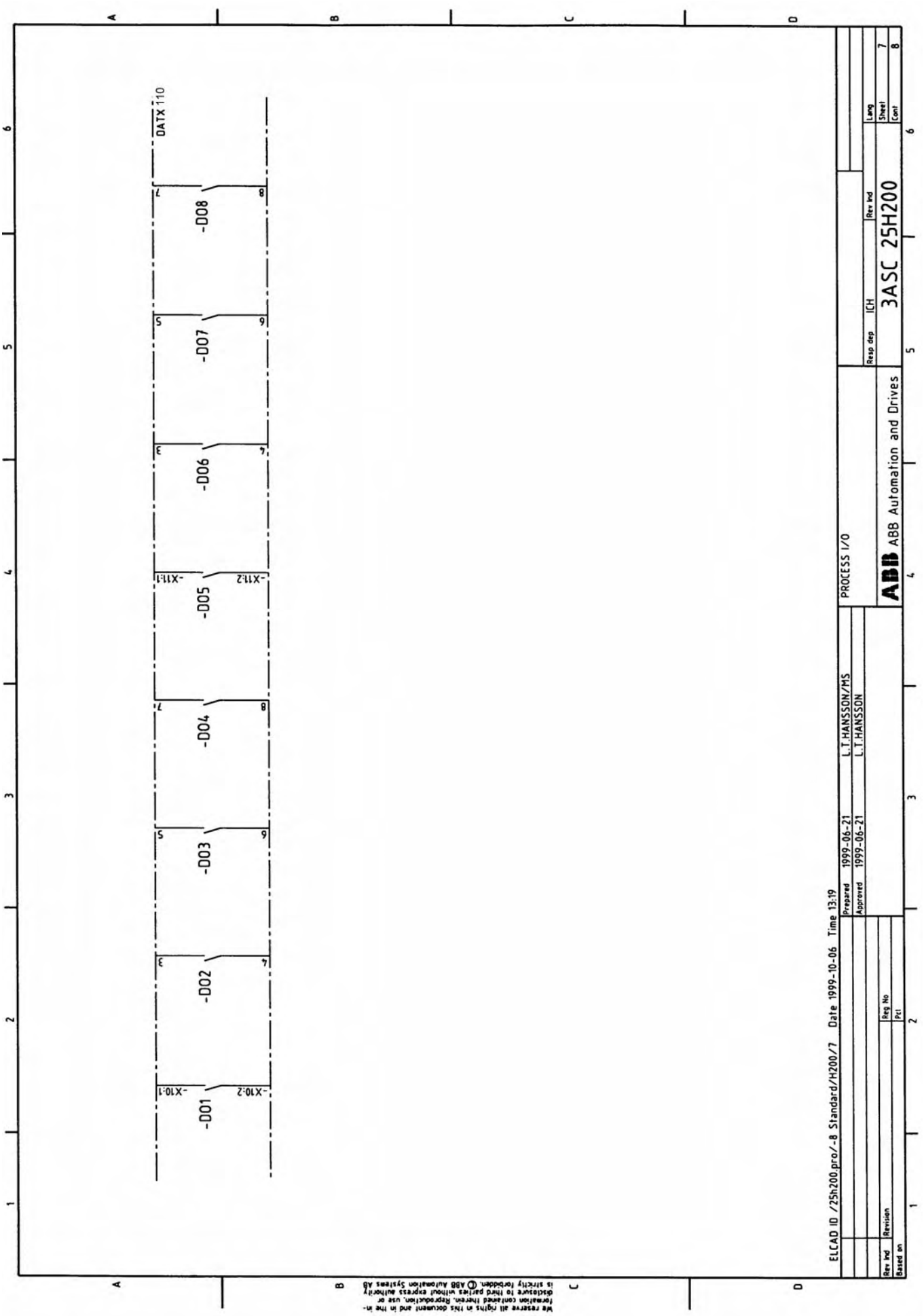


TACHOMETER

ELCAD ID /25h200.pro/-8 Standard/H200/6 Date 2001-03-15 Time 12:39

		Prepared	1999-06-21	L.T.HANSSON/MS	PROCESS I/O
		Approved	1999-06-21	L.T.HANSSON	
Rev Ind	Revision	Reg No			ABB Automation and Drives
Based on		Pcl			3ASC 25H200

Resp dep ICH | Rev Ind | Lang
Sheet 6
Cont 7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Prepared 1999-06-21 L.T.HANSSON/MS
Approved 1999-06-21 L.T.HANSSON
PROCESS I/O
ABB Automation and Drives
Resp dep ICH
3ASC 25H200
Rev Ind
Revision
Based on
Reg No
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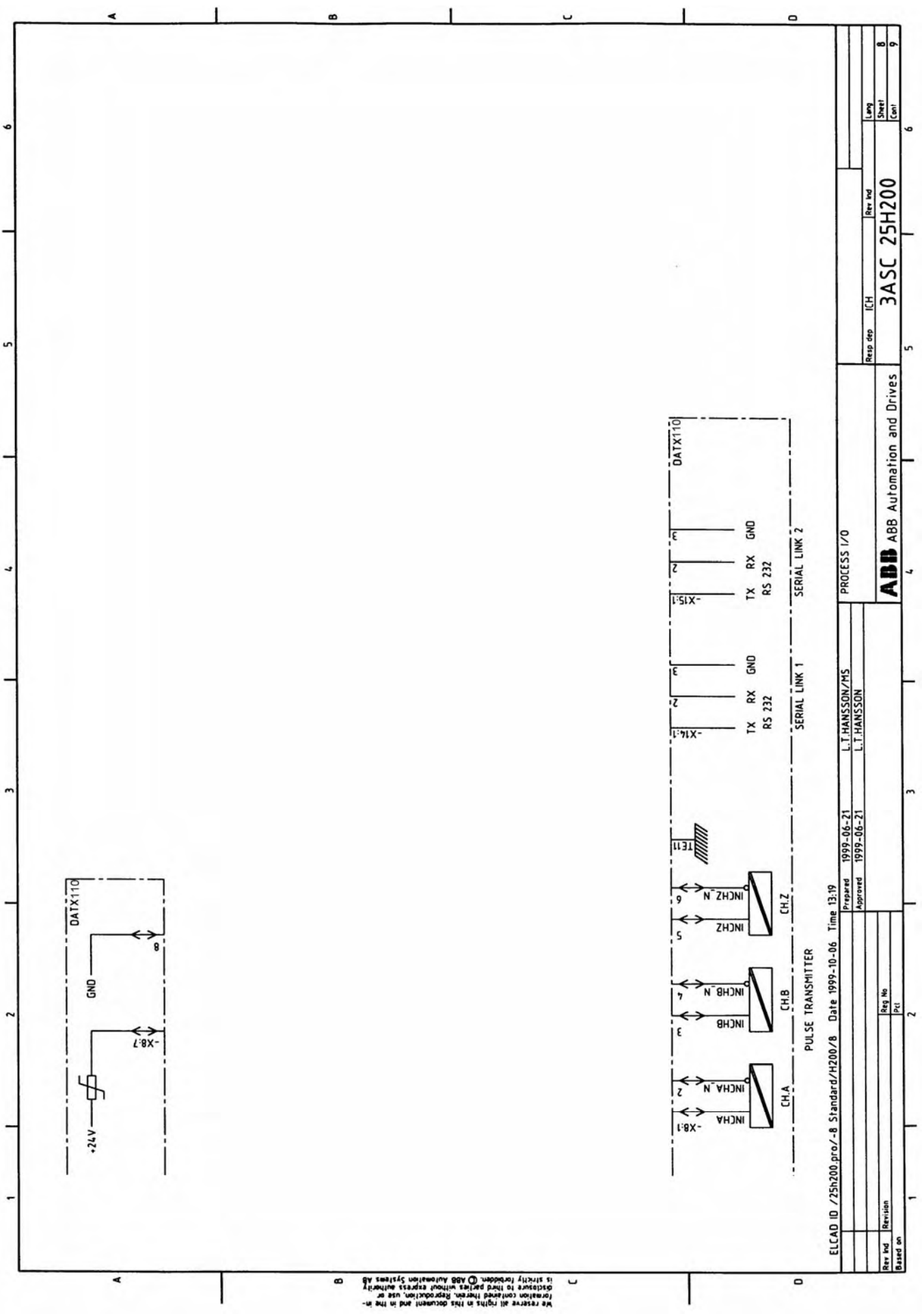

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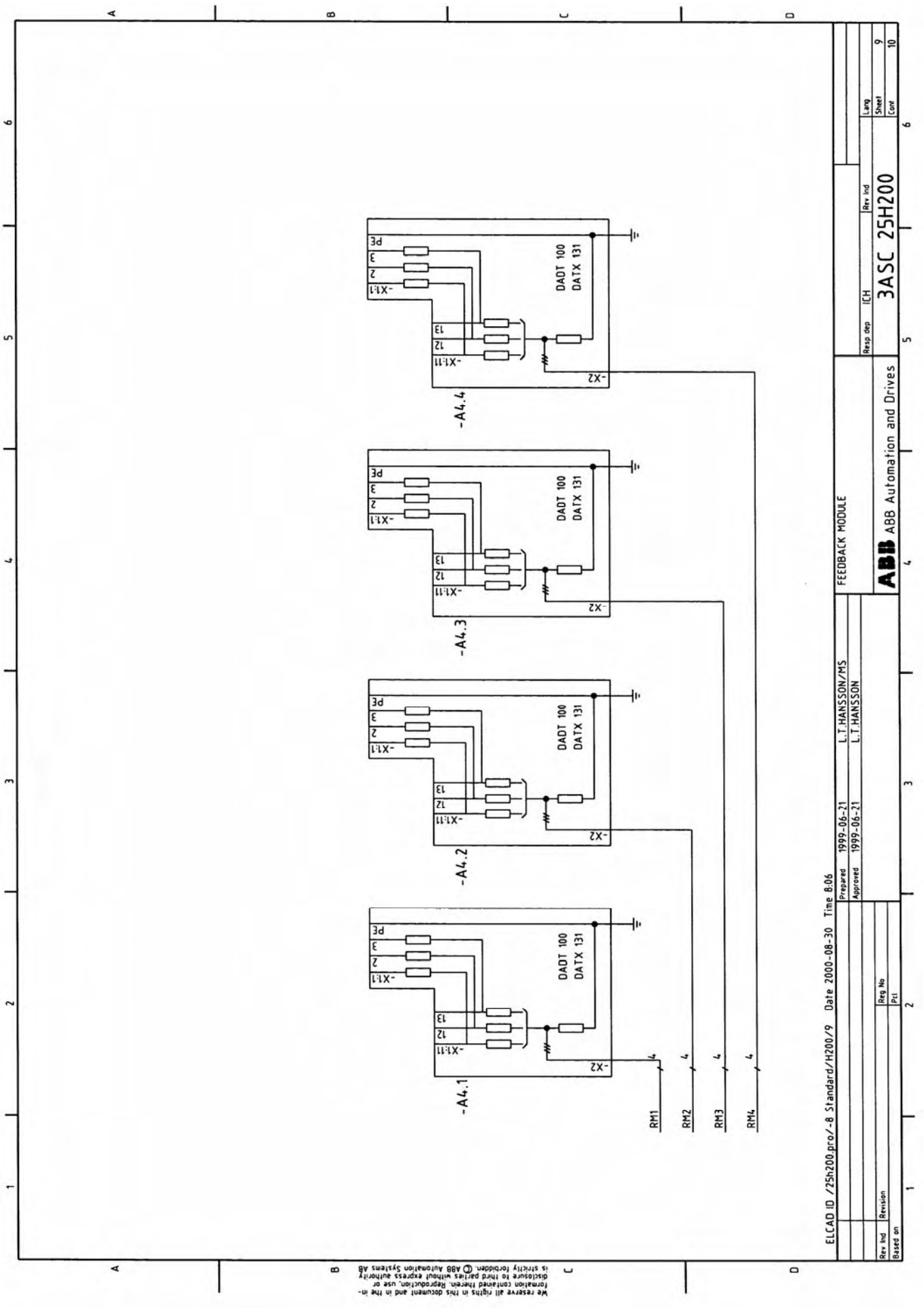
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PE
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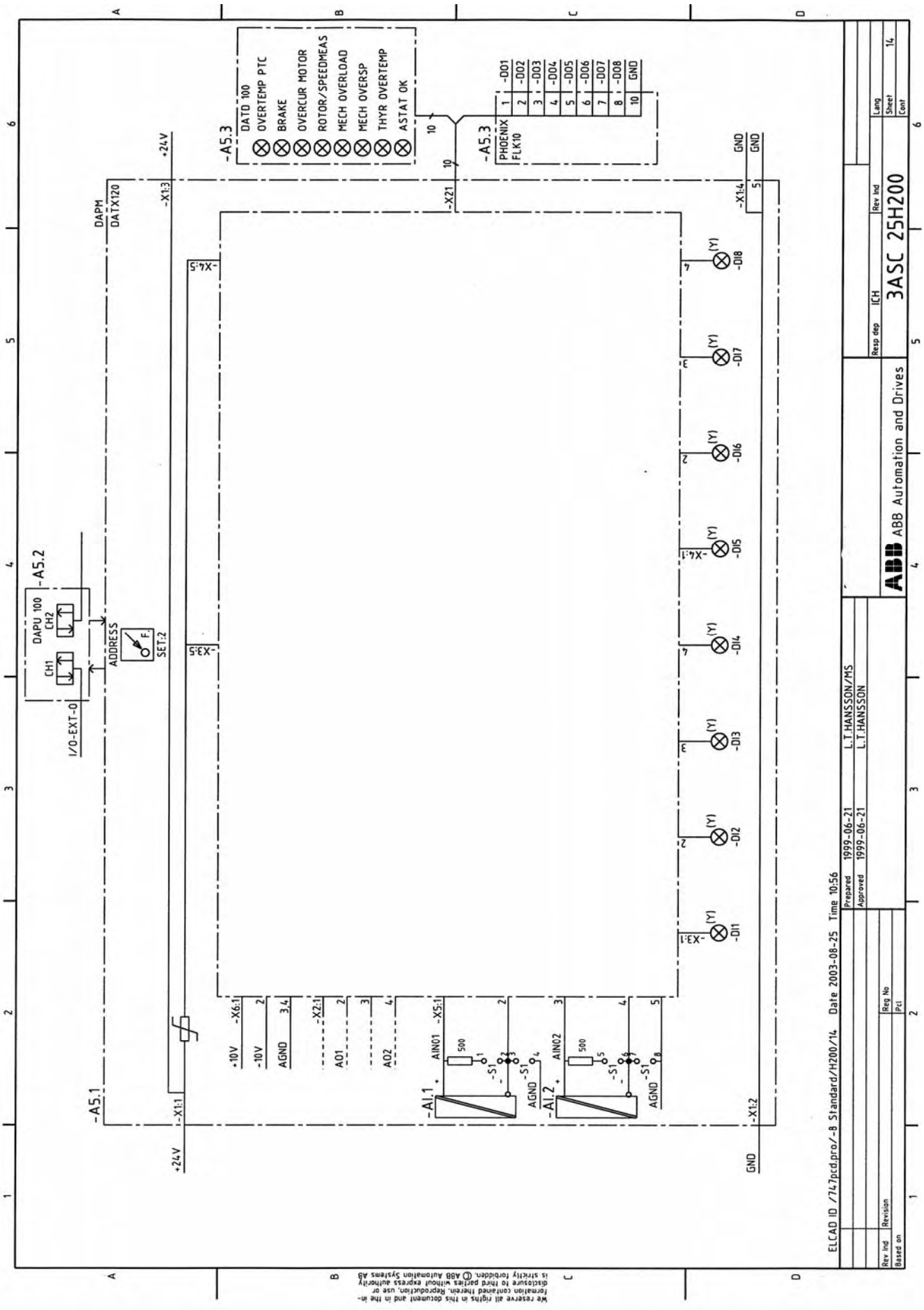
2
13
12
RM1
RM2
RM3
RM4
FEEDBACK MODULE
ABB Automation and Drives
3ASC 25H200
L.T.HANSSON/MS
L.T.HANSSON
1999-06-21
1999-06-21
ELCAD ID /25h200.pro/-8 Standard/H200/9 Date 2000-08-30 Time 8:06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OVERCUR MOTOR
ROTOR/SPEEDMEAS
MECH OVERLOAD
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THYR OVERTEMP
ASTAT OK
-A5.3
PHOENIX FLK10
-DO1
-DO2
-DO3
-DO4
-DO5
-DO6
-DO7
-DO8
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DAPM
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+24V
-X1:3
-X21
-X1:4
GND
-A5.2
DAPU 100
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CH1
I/O-EXT-0
ADDRESS
SET:2
-X4:5
-X3:5
-X4:1
-X3:1
-DI8
-DI7
-DI6
-DI5
-DI4
-DI3
-DI2
-DI1
-A5.1
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-X1:2
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+10V
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AGND
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AO2
AIN01
AIN02
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ABB Automation and Drives
3ASC 25H200
Resp dep
TECH
Rev Ind
Lang
Sheet
Cont
14
Prepared
Approved
1999-06-21
1999-06-21
L.T.HANSSON/MS
L.T.HANSSON
ELCAD ID /747pcd.pro/-8 Standard/H200/14 Date 2003-08-25 Time 10:56
Rev Ind
Revision
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Reg No
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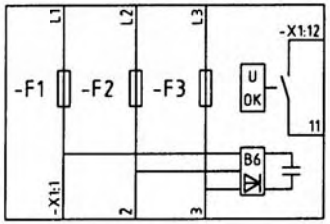

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Prepared	1999-06-21	L.T.HANSSON/MS	OVERVOLTAGE PROTECTION MODULE DASG 120/121
Approved	1999-06-21	L.T.HANSSON	
Rev Ind	Revision	Reg No	ABB ABB Automation and Drives
Based on		Ptl	

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