

1.3. Control system

1.3.1. Stand alone Motion Control

The control board is built up around a micro controller unit, DAPC 100. It has following main data:

- Data bus size 16 bit
- Address bus size 18 bit
- Clock frequency 16,384 MHz
- Interrupt levels 7
- Watch supervision 2 levels
- Time out supervision 50 μ s
- Interval clock Programmable
- On board EPROM 512 Kbytes
- On board RAM 64 Kbytes
- MCU Internal RAM 2 Kbytes
- Debug interface (BDM) 1
- Thyristor bridges interface 2
- Power Supply Monitor

The system interface units, i. e. Process I/O, and Cabin I/O, are designed by using a common I/O communication controller board and a unit specific termination board.

The DSP-equipped Rotor observer board DATX 130 gets speed and condition status from the motor's or motors' slip rings.

The DSP-equipped Torque observer board DATX 132 evaluates the shaft torque of the motor(s).

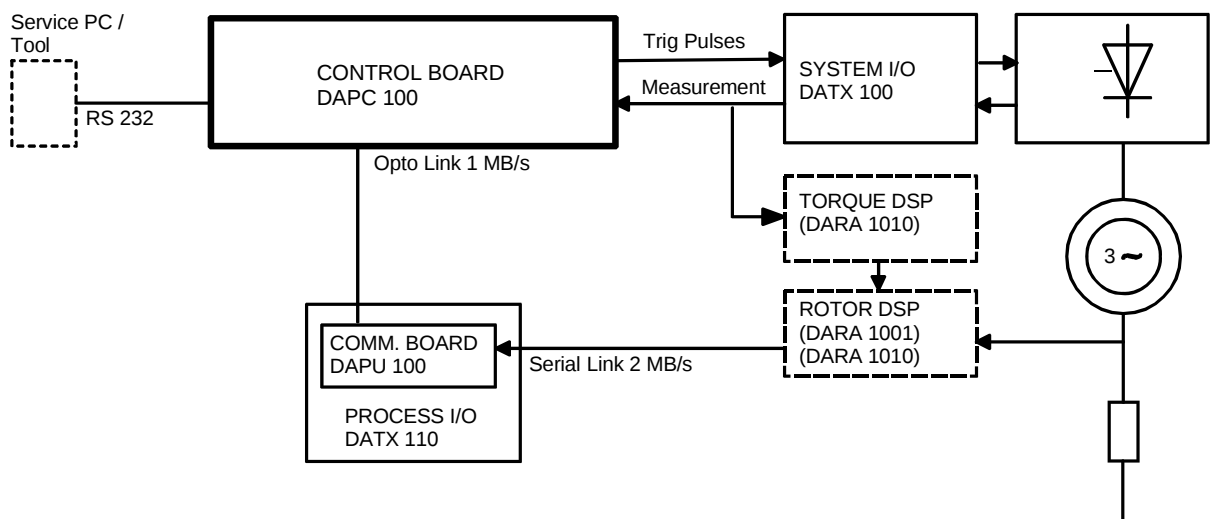
The boards mentioned above contain the latest generation of electronics, and have as a consequence short creepage distances between different potentials. The boards are for this reason specially adapted to the dusty conditions in the heavy industry by coating. It is allowed that the dust is conductive, like in metal industry.

All information channels between units, both inside modules and for longer distances, are based on fiber. With HCS technology, no practical limitation in distances exists on board a crane; see the Cabling instruction in Chapter 2.

The System I/O board is mounted inside the ventilated thyristor module. The board is designed with reasonable distances between potentials and its surface is coated to withstand the dust ingress. This board couples the control system to the power circuit by means of pulse transformers.

All parts of ASTAT are selected, designed or loaded in such a way that the installation temperature is permitted to reach more than +70 °C continuously.

ASTAT is a modular system that includes all options from the single drive without tachometer or pulse-encoder to a complete system for automating the crane.

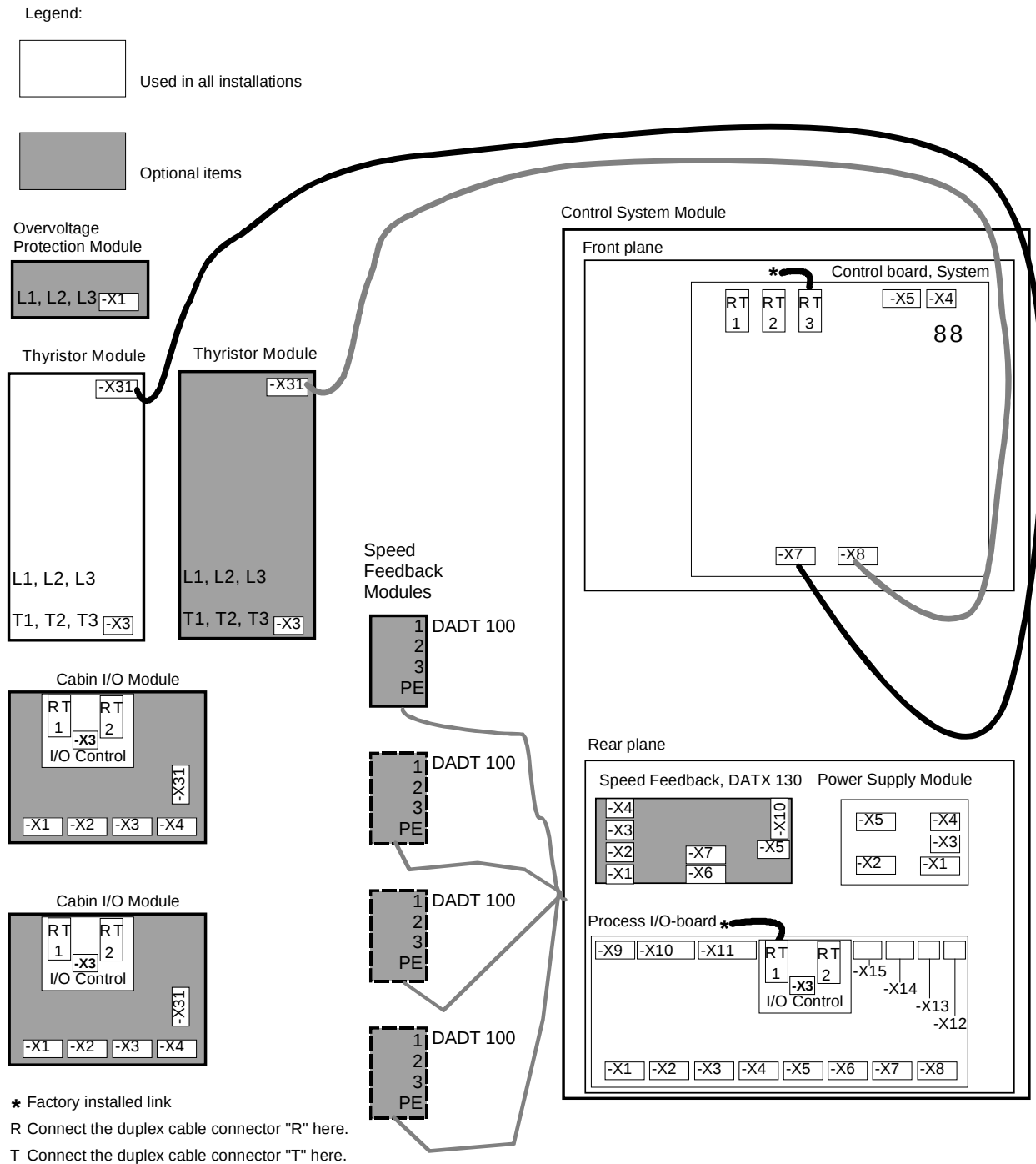


Above: Stand alone ASTAT system

Comments: The not-dotted frame components in the figure above (except the PC and the RS 232-cable) are parts of Control System Module DARA 1000 and one Thyristor Module DASD. A tachometer or pulse-encoder is required for speed control. The Control System Modules DARA 1001 and DARA 1010 do not need tachometer or pulse-encoder.

2.2. Detailed connection list

In the figure below all terminal groups for the Crane Motion Controller are shown. Prepare the study of this section by selecting and printing out the suitable forms in Section 11, Installation Diagram Forms.



Hint: Use the EXCEL "Interface_generator_xx.xls" of the Tool software to easily get the actual signal list for a particular application. xx is a number 01 - 99.

2.2.2. Control System Module connection

Control System Module DARA 1000, DARA 1001 and DARA 1010
The modules have fixed as well as configuration dependent connections.

- **Power Supply Module**
 - **Supply 115 / 230 V AC:** L1 on -X1:1 and : (3).
L2/N on -X1:2 and : (4)
For connection with 115 V AC:
Strap Power supply module
-X1:5 to 7 as well as -X1:6 to 8

For connection with 230 V AC:
Strap Power supply module
-X1:6 to 7
 - **Fan connections for DASD 145, 146, 147, 156, 157:**
Connect the fan to 220 V AC without wiring inside the Control System Module DARA.
We recommend via a contactor controlled by DO no. 1.
 - **Fan connections for DASD 102, 103, 104, 105, 152, 153, 154, 155:**
Fan no.1 to -X3:1 and :2
Fan no.2 to -X3:3 and :4 (DASD 104, 105, 152, 153, 154, 155)
We recommend via a contactor controlled by DO no. 1.
 - **Fan connections for DASD 00x:**
Fan no.1 to -X2:3 (red) and :4 (blue)
Fan no.2 to -X2:3 (red) and :4 (blue) (two leads in same terminal)
We recommend via contactor controlled by DO no. 1.
 - **110 V DC Detection Voltage**
Directly grounded system (Normal) Power supply module -X2:9 to Ground.
Floating grounded system (Special installations) Power supply module -X2:10 to Ground.
- **Control board system, DAPC 100**
Information channels:
 - -X5: PC-connection via multi-drop RS 485 (DADT 114 and DADT 124) or point-to-point RS 232 Tool connection.
 - Opto links:
Channel 1, Opto pair connection to TCP / IP controller (Vertical communication), or to other ASTAT in dynamic Horizontal communication mode. **MC**
Channel 2, Opto pair connection to other ASTAT (Horizontal communication). **M/F**
Channel 3, Internal fiber connection to Process I/O, DAPU 100. **I/O**
 - 24 V DC connection: -X4 (Internally connected)

Thyristor Module Control cable: -X7 (System cable).
Routed via DATX 130 for DARA 1001 and 1010 modules.

Thyristor Module Control cable: -X8 (System cable); only used for parallel Thyristor modules.

4.1.2. Parameters

Description	MIN	MAX	NORM	SET	IDENTITY	English text
Motion identity.	1	255	1	D	0101	DR_ADD
0=The standard MF-port is used for MF-communication. 1=The MC-port is used for MF-communication. This function is used for redundant systems.	0	1	0	X	0102	MFCMPORT
0=Change takes place during CRANE OFF (as until AST10_04) 1=Change takes place during standstill with Master switch in neutral position 2=Change takes place during CRANE OFF and standstill with Master switch in neutral position 3=Change takes place during standstill with Master switch in neutral position, and DI 7 of Cabin I/O is high. DI 7 used in this way has higher priority than Step 4 function and Load display tare function.	0	3	0	X	0103	MACROMOD

4.1.3. Signals

Description	Unit	IDENTITY	English text
The version of the ASTAT program. 10_05 is indicated by 10.05, etc. Older versions than AST10_02 will give 00.00	-	0151	AST_VERS
The generation of control board DAPC 100. 10_05 can be run on at least generation 1 and 2 of DAPC 100.	-	0152	BOARDGEN
The version of software of Rotor measurement unit DATX 130. Version 1 is labelled R1 ; version 2 is labelled R2 etc. The signal gives a value 0, 2, 3..... Value 15 is given when no DATX 130 is used (i. e. for DARA 1000) and for earlier versions than R2. Value 2 is given for version R2; value 3 is given for version R3 etc. Version of ASTAT program 10_05 (see signal 01.51 above) requires software version R2 of DATX 130.	-	0153	RSW_GEN

- Motion no. 2 uses parameter set no. 3 as first (=normal) parameter set and no. 4 as second parameter set. Digital input no. 4 on the process I/O board DATX 110 will switch over to the second parameter set for this motion that is parameter set number 4.

Parameter setting of parameter **05.03**:

- Parameter sets number 1 and number 2 must be the same. Either 12 or 22.
- Parameter sets number 3 and number 4 must be the same. Either 12 or 22.

4.5.1.4. Type of Limit switch

During normal service the limit switch H slows down the motion in direction A (≡Up/right), and limit switch HH stops it. In direction B (≡Down/left) L slows down, and LL stops.

4.5.1.4.1. Four switches

Considers traditional limit switches HH, H, L and LL. There are settings of parameter **05.04** to either totally bypassing the limit switches or to keep using them, but suppressing the evaluation of impossible combinations of the four switches.

4.5.1.5. Shall an input be used or not?

ASTAT contains a foreseen maximum number of input signals, and has of this reason for most motions more input signals when required.

Parameters **05.05 - 05.08** (USE_PTC1 etc...) shall be set to 0 if there is no PTC connected.

Parameters **05.09 - 05.20** (USE_DI05 etc...) shall be set to 0 if there is no signal connected.

Parameters **05.21 - 05.24** (USE_ROT1 etc...) shall be set to 0 if there is no live DADT 100 connected to board DATX 130 plug -X1 etc inside DARA 1001 or DARA 1010.

4.5.1.6. Rotor feedback information

Only applicable for DARA 1001 and DARA 1010.

Set parameters **05.21 - 05.24** to 1 if a motor's rotor is connected to it, and it is desired to monitor the rotor.

In case the speed feedback is made with tachometer or pulse encoder, a rotor is supervised in case the corresponding parameter is set to 1. Each time the motion is started, the "next" rotor is selected for supervision.

Example: **05.21** = 1, **05.22** = 0, **05.23** = 1, **05.24** = 0. At first start rotor of motor 1 is supervised, at second start rotor of motor 3 is supervised, at third start rotor of motor 1 is supervised In case the pointed out rotor fails, the motion continues.

In case the feedback is the rotor frequency, parameters **05.21 - 05.24** only the same rotor as used for the speed feedback can be used for supervision. The other must be off. In case the pointed out rotor fails, the motion stops.

Example: **05.25** = 2. **05.21** must be 0, **05.22** can be 0 or 1, **05.23** must be 0, **05.24** must be 0.

Set parameter **05.25** to define which of the motors that is active as speed feedback for Rotor feedback. 1 for first input to DATX 130, 2 for second, 3 for third and 4 for fourth input to DATX 130. Value has no importance if other speed feedback is used.

4.5.1.7. Thermistor action

PTC inputs PTC3 and PTC4 can be used for trip (normal setting) or warning while PTC1 and PTC2 are only for trip.

With parameter **05.26** = 0, a high resistance value for PTC3 or PTC4 only gives a flashing indication. With parameter **05.26** = 1, a high resistance value for PTC3 or PTC4 gives a trip (same result as for PTC1 or PTC2).

4.5.1.8. Different parameter sets

It is only allowed to change parameter sets under the conditions given by parameter **01.03**, MACROMODE. Basically there is a selection between two parameter sets with DI no.4 of the process I/O, but it can be extended to four parameter sets with a parameter **05.27** (STA2_PA2).

05.27 = 0 No restriction			
DI no.3 = 0	DI no.3 = 1	DI no.4 = 0	DI no.4 = 1
Operator station no. 1 active	Operator station no. 2 active	Parameter set no. 1 used	Parameter set no. 2 used

05.27 = 1 05.27 = 1 is not possible for Shared motion. 05.27 = 1 is not possible for duty with master switch connected direct to DARA, i. e. 02.01 = 5 .			
DI no.3 = 0	DI no.3 = 0	DI no.3 = 1	DI no.3 = 1
DI no.4 = 0	DI no.4 = 1	DI no.4 = 0	DI no.4 = 1
Parameter set no. 1 used	Parameter set no. 2 used	Parameter set no. 3 used	Parameter set no. 4 used

Process I/O digital input no.3 can be used in two ways:

- 1) To select between operator stations
- 2) To make the selection between parameter sets 1 or 2 (Low sets family) or parameter sets 3 or 4 (High sets family)-selection within the family is done by Process I/O digital input no.4.

With **05.27 = 0**, a high value (=110 V) on DI no.3 on process I/O board DATX 110 will use DI no.3 to select between operator station number two out of number one and number two.

With **05.27 = 1**, a low value (=0 V) on DI no.3 on process I/O board DATX 110 will use parameter sets 1 and 2. The selection between Sets 1 and 2 is made with DI no.4.

With **05.27 = 1**, a high value (=110 V) on DI no.3 on process I/O board DATX 110 will use parameter sets 3 and 4. The selection between Sets 3 and 4 is made with DI no.4.

4.5.1.9. Prevention of motion at Crane On

Sometimes a hydraulic pump for emergency brakes is started at the same time as the crane motions are powered. It can take a few seconds to build up the pressure and lift the brake shoes. During that period the motors must not be used. It is possible to prevent motion during that time.

Parameter **05.33** is used. The normal setting 650 ms covers all configurations with only ASTAT itself concerned.

4.5.1.10. Fast stop

It can be useful to stop a motion in a controlled way by electrical braking independent of the position of the master switch. Example: In an operation with two hoists one hoist stops of any reason. Of safety reasons the other "healthy" hoists should stop at the same time, and the driver can after that deselect the faulty hoist and restart with only the "healthy".

The activation signal to stop is given to DI 17, same as used for parallel bridge supervision. Of this reason the Fast stop function is not available for parallel bridges

Parameter **05.36** is used to set up Fast stop function.

4.5.2. Parameters

Description	MIN	MAX	NORM	SET	IDENTITY	English text
Rated current of the Thyristor module. In case of Parallel bridge combination, I _e is the sum of the two units together. Unit: A.	25	2200	25	D	0501	IN_ASTAT
Parameter to set whether the configuration shall be 11 for "Hoist without Shared Motion", 12 for "Hoist with Shared Motion", 21 for "Travel without Shared Motion", or 22 for "Travel with Shared Motion".	11, 12, 21, 22	11, 12, 21, 22	11	D	0503	DRI_TYPE