DYNAC Vector

Service Manual

CAUTION

1. Before starting read carefully instructions and this table.
2. Verify all connections are according to drawings.
3. Verify motor supply is connected correctly, wrong connection will destroy the inverter.
4. Verify internal voltage selections of device are correct.
5. Check device cover is properly installed and all ventilation holes are clear and uncovered.
6. Check that hot air coming from brake resistors does not cause any danger.
7. High voltages are present in this device. Do not make any inspections unless the supply has been disconnected by main switch. Before opening the device cover, wait at least 5 minutes after the display lamps turn off.
8. Insulation resistance test with a megger requires special precautions.
9. Do not make any measurements inside the device when it is connected to main supply.
10. Do not touch the IC-circuits on the circuit boards. Static voltage discharge may destroy the components.
11. It is forbidden to use radiophones and portable phones near this device with the doors open.
12. All the doors and covers must be closed during crane in operation.

CONTENTS

1 DESCRIPTION OF DYNAC

DynAC can be summarized as a "crane travelling motor control system, which controls the speed by changing the frequency of supply voltage of a squirrel cage motor". A stepless speed adjustment can be achieved by this method.

Type marking is shown below. Technical data is given in Appendix.

DynAC V — **Device name**

7.5 — **Power rating class**
DynAC V — *2.2J - 45J, 2.2F - 800F, 2.2K - 630K*

F — **Supply voltage**
- *J* — *200 - 240VAC, 50/60Hz*
- *F* — *380 - 500VAC, 50/60Hz*
- *K* — *525 - 690VAC, 50/60Hz*

Revision code
33 — *The latest DynAC may be of different revision.*

B — **Braking type**
- *A* — *External resistor*
- *B* — *Internal resistor*
  - *- up to 22J*
  - *- up to 30F*
  - *- up to 22K*
- *W* — *Network braking*
- *0* — *No braking*

DynAC V 7.5 F 45 - B - L - P - 0 - 0

Display type — **L**
- *L* — *LED-display*
- *G* — *Graphical display*

Expansion — **P**
- *P* — *Expander*
- *N* — *Encoder*
- *U* — *Profibus-DP*

EMC-level — **0**
- *0* — *Standard* — *EN61800-3*
- *E* — *Industrial* — *EN61800-3*
- *C* — *Commercial* — *EN61800-3*

Special — **0**
- *0* — *None*

Advantages of stepless speed control

- improved positioning accuracy due to a low minimum speed
- reduced mechanical stresses due to soft start and stop
- reduced brake wear due to electric braking; the mechanical brake is used only as a holding brake
- easier to use for inexperienced operators; the less experienced the operator is, the slower he/she can drive to avoid damaging the load. With DynAC the productivity of the crane can be improved
- both a very low creeping speed and a very high main speed can be utilized

Advantages of frequency control compared to other stepless speed control systems

- squirrel cage motor; inexpensive, minimal need for maintenance, simple and robust construction, good tolerance to bad ambient conditions, small size, low weight
- selectable maximum frequency and speed; not dependent on the supply voltage
- a wide speed control range; minimal driving time restrictions at low speeds (minimal motor heating)
- minimum amount of external components; no rotor resistors, no tachometer
- good efficiency and power factor
- low starting current; proportional to the desired acceleration rate

Advantages of DynAC compared to other inverter based systems in travelling motion

All the crane specific functions are included as standard features
- safety circuitry
- crane specific user interface
- electric braking including resistors
- limit switch functions
- the area between the slowdown and the end limit switches can be fully utilized by using the distance proportional function, which limits the speed proportionally to the travelled distance
- motor thermal protection; thermistor relay function
- mechanical construction specially designed for cranes (a specific DynAC cubicle, which usually is placed in the bridge cubicle row)

1.1 Functional description

DynAC main components are:

			F-series	J-series	K-series
A1	Inverter		2.2-800F	2.2-45J	2.2-630K
A2	Expansion board	Expander	2.2-37F	2.2-45J	2.2-55K
		Encoder	2.2-800F	2.2-45J	2.2-630K
		Profibus-DP	2.2-800F		2.2-630K
A3	I/O-board (DynABoard KAE250)		2.2-800F	2.2-45J	2.2-630K
T1	Control voltage transformer		2.2-800F	2.2-45J	2.2-630K
K1	Line contactor		2.2-800F	2.2-45J	2.2-630K
F7	Circuit breaker		2.2-800F	2.2-45J	2.2-630K
K7	Brake contactor		2.2-160F	2.2-45J	2.2-132K
K01	Auxiliary contactor for the line contactor		55-800F	30-45J	90-630K
K71	Second brake contactor		55-800F		30-630K
F71	Circuit breaker for the second brake contactor		55-800F		30-630K
T2	Control voltage transformer		400F	30-45J	90-630K
A11	Inverter of parallel unit		500-800F		400-630K
T11	Control voltage transformer in parallel unit		500-800F		400-630K
K11	Main contactor in parallel unit		500-800F		400-630K
F17	Circuit breaker in parallel unit		500-800F		400-630K
B-models only					
R1	Internal braking resistor unit		2.2-30F	2.2-22J	2.2-22K

The most important external components are:

R1-R4	External braking resistor units for A-models (quantity depends on the power rating class of DynAC)
M1	Travelling motor
Y1	Mechanical brake
B6	Encoder (N-models)
	Control devices (switches, pushbuttons, potentiometers etc.)
	Limit switches

See circuit diagrams for following descriptions of operation.

Operation when power is connected to DynAC

- Limit switches S11, S12, S21 and S22 are assumed to be closed, as well as the emergency stop button ES.
- If F7 is closed, as it normally is, the control voltage transformer T1 supplies the 48V voltage to A3 control inputs (external 48V, 115V or 230V voltage can be used too).The internal 48V control voltage is connected to EST-signal and the DynAC line contactor K1 is energized (in models 55F-800F, 30J-45J, 90K-630K, via the auxiliary contactor K01). After the fault circuit is OK, DynAC is ready to operate in about 1-2 seconds.
- If either of the direction signals S1 or S2 is on, the DynAC display shows F52 and driving can begin only after the direction signals have been off for a while.

Normal operation

- For the description of the speed reference setting see chapters 1.3 "Control methods" and 2.3 "Description of parameters".
- Travelling starts when switch S1 (S2) closes. Closing the contact 22-23 on A1 energizes K7 which opens the brake (in models 55F-800F, 30K-630K the brake is controlled by K71). DynAC accelerates according to the acceleration ramp setting to the selected speed.
- When the switch S1 (S2) opens DynAC stops according to the deceleration ramp setting and the brake closes.
- R1-R4 dissipate the regenerated energy during deceleration periods. The power supply to R1-R4 is controlled by A1.

Other features

- Slowdown limit switches S11 and S21 provide position dependent frequency limiting. See description of parameter P5.2 in section 2.3.5.
- Any reason which causes K1 to de-energize (like opening of contact ES) switches power off from inverter A1.
- Thermistor relay function, which can be used when needed.
- When the stop limit switch S12 or S22 opens, K7 (K71 in models 55F-800F, 30K-630K) de-energizes and the mechanical brake stops the motion.
- DynAC can be equipped with the encoder option (B6).
- The extended speed range ESR can be used, if the signal FWE (field-weakening enabled) is on. Then it is possible to drive up to twice the nominal speed depending on the application.

1.2 Motor control modes

DynAC has several motor control modes for open loop and closed loop vector control:

- Frequency control, open loop
- Speed control, open loop and closed loop
- Torque control, closed loop

The most used modes for DynAC are frequency control, open loop speed control and closed loop speed control.

In DynAC frequency control (P-models) the actual speed depends on the load. The speed accuracy is proportional to the slip of the motor.

In frequency control mode the motor frequency follows the frequency reference signal. This method is most suitable for bridge travelling control in cases where both ends of the bridge are driven with separate DynACs and as well for any application, where two or more DynACs control the same motion with several separate machineries, which are mechanically coupled together.

In DynAC open loop speed control (P-models) the actual speed depends on the load. The lowest possible driving frequency is nominal slip plus a small margin. The speed accuracy of open loop vector control is 1% of nominal speed at speed range 10 ... 100% and 1/3 of motor nominal slip at speed below 10%.

In DynAC closed loop speed control (N-models) the actual speed is equal to the reference. The speed accuracy of closed loop vector control is 0.01% of nominal speed.

In speed control mode the motor speed follows the speed reference signal. DynAC adjusts the motor frequency and with this function compensates the load-dependent slip. This method is suitable for most bridge and trolley travelling applications. The slip compensation keeps the actual shaft speed constant and independent of loading conditions. With open loop speed control, the applicable minimum speed is about one third of motor rated slip.

The torque control is only used for special applications such as free wheeling.

1.3 Control methods (= command modes)

There are four different control methods (command modes) available:

1 EP – Electronic motor potentiometer function.
- stepless control using a 2-step pushbutton controller.
- EP3 stepless control using a 3-step controller.

2 PO – Potentiometer control using a joystick type controller.
- requires a single 15V power supply (included in DynAC).
- any additional amplifier is not needed.
- see also description of parameters P3.6 - P3.9 and potentiometer specification (Appendix A5).

3 AU – Automation control for any control device with an output in the range of 0-10V.
- e.g. radio-controls, process computers.
- see also description of parameters P3.11 - P3.14.

4 MS – Multistep control (2-4 steps as standard)
- up to 8 steps available (see description of parameters P5.9 - P5.16).

All four control methods are available without any changes in the hardware or software. Any single DynAC can be controlled (for example) by a pushbutton controller in EP-mode, by a joystick type controller with a potentiometer located in the cabin in PO-mode or by a process computer in AU-mode. The only external device needed is a switch to select the desired control method.

If required, two or more DynACs can be driven in precise synchronization. A separate synchronization controller is needed for this. The same speed reference (in EP- or PO-mode) is connected to all DynACs and the correction signal for synchronization is connected to all DynACs depending of the model to the AS-input (P-models) or to the KR-input (N-models). The speed reference signal of each DynAC can also be modified separately by a PLC. Synchronization is activated by parameter selection.

Multistep control is usually done with the MS-control function. An other method for multistep is to use AU-control and an additional PC-board KAE165.

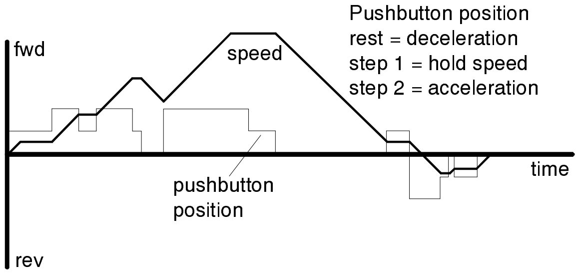
Command mode selection

The command mode (EP, PO or AU) is selected by the switches CMS and AP. Normally the selection can be done only when the motion is stopped (not when running), but in special applications changing the mode is allowed during run by changing parameter values.

Command mode selection		
Mode	CMS	AP
AU	closed	open
PO	closed	closed
EP	open	closed at 2. step (acceleration signal)
MS	selected by parameters	

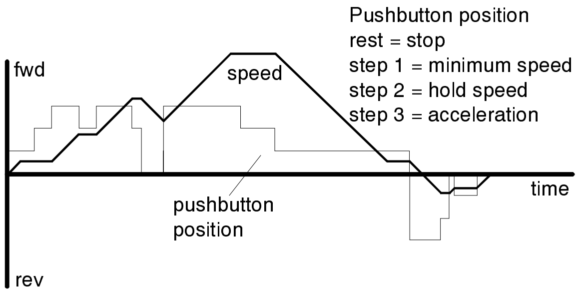
Description of the control methods

In **EP-control** there are two 2-step pushbuttons, one for each direction. The operation is as follows:
- the rest position means standstill (0-position)
- during run the rest position means deceleration
- step one (switch S1 or S2) means hold speed
- when starting, step one means acceleration up to the minimum speed
- step two (switch AP) means acceleration (up to the maximum speed if desired)
- at the maximum speed step two means hold speed, because the maximum speed cannot be exceeded



EP-mode

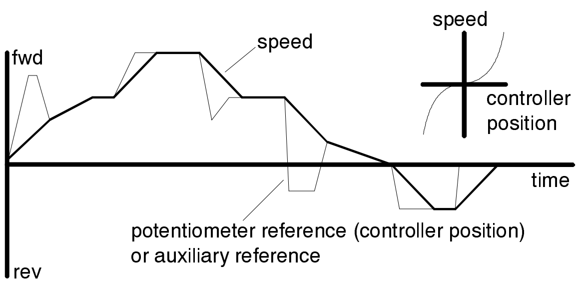
In **EP3-control** there is a 3-step controller. The operation is as follows:
- the rest position means standstill (0-position)
- step one (switch S1 or S2) is the minimum speed command
- step two (EP hold command) means hold speed
- step three (switch AP) means acceleration (up to the maximum speed if desired)
- when releasing the controller, step one means deceleration down to the minimum speed



EP3-mode

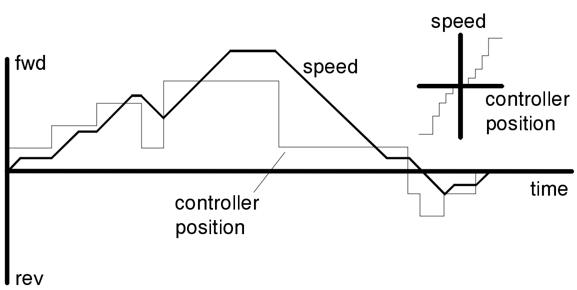
The operation in **PO-control** is as follows:
- when the controller is at the rest position the potentiometer is at the middle position causing zero speed
- run commands are controlled separately by closing the direction switches (S1 and S2)
- when the operator turns the controller to any direction, the speed increases
- the same turning angle of the controller causes a smaller change in speed, the closer the speed is to the minimum speed

The operation in **AU-control** is as follows:
- the speed linearly follows the input signal. 0V means zero speed and the higher the voltage, the higher the speed
- run commands are controlled separately by closing the direction switches (S1 and S2)



PO- and AU-modes

MS-control has a 2-4-step controller (up to 8 speed steps available depending on controller). The operation is as follows:
- each step has its own frequency
- the frequencies are freely selectable
- when controller is set to a certain step, the speed changes to equal value



MS-mode

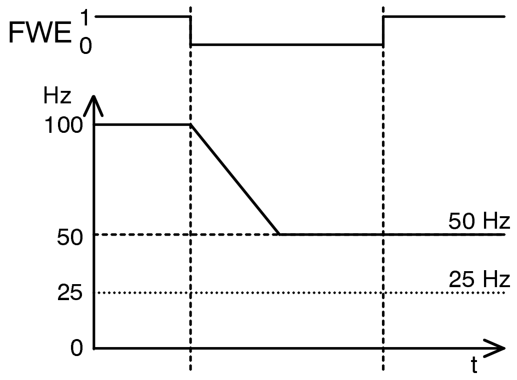
More information on using the different control methods is given in Section 2.3 "Description of parameters". More information about the PO-control potentiometer function is given in Appendix A5 "Potentiometer specification".

The effect of FWE-signal on speed

The extended speed range ESR can be used, if the signal FWE (field-weakening enabled) is on at start. Switching FWE-signal off during run disables the extended speed range. Switching FWE-signal on during run does not allow acceleration to the extended speed range. The maximum frequency at field weakening (f_{max}) is adjustable by parameter P5.6. The acceleration and deceleration times for ESR are scaled from nominal speed.

In EP- and MS-modes the FWE-signal affects on the output frequency with speeds higher than nominal speed (f_n).

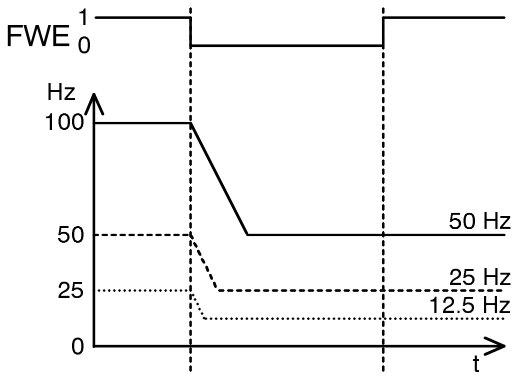
In the picture at right
f_n = 50Hz and f_{max} = 100Hz



EP-mode

In PO- and AU-modes when FWE-signal is on the output frequency proportionally follows the secondary reference upper limit (P5.6), also with speeds lower than nominal speed.

In the picture at right
f_n = 50Hz and f_{max} = 100Hz

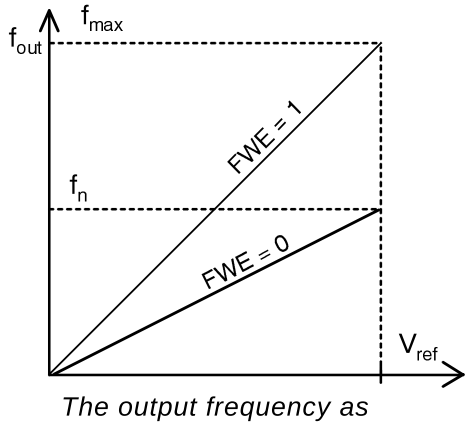


PO- and AU-mode

In PO- and AU-modes when field weakening is enabled (FWE-signal is on), the speed reference is multiplied by factor

$$\frac{f_{max}}{f_n}$$

The picture at right shows the output frequency f_{out} as a function of speed reference V_{ref} in PO- and AU-mode.



The output frequency as a function of speed reference in PO- and AU-mode

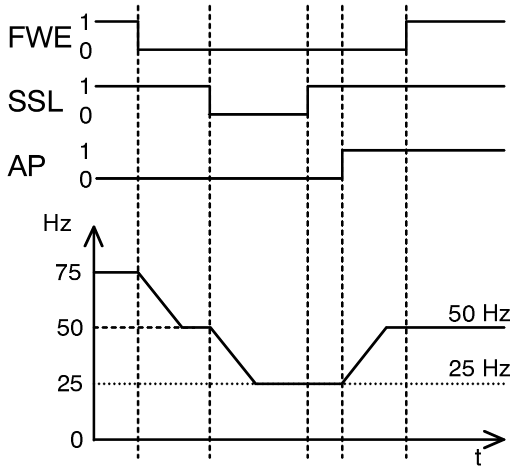
The effect of SSL-signal on speed

The second speed limit SSL can be used freely during run. Switching SSL-signal off during run activates the second speed limit. Switching SSL-signal on during run allows acceleration back to maximum frequency. The maximum frequency at second speed limit is adjustable by parameter P5.7. SSL-setting value may be as well in ESR-range as in normal range.

In EP-mode when second speed limit is active (SSL-signal is off) the maximum output frequency is limited. The second speed limit can be switched on or off during run.

If AP-signal has been off when second speed limit became active, the speed does not accelerate until AP-signal is switched on.

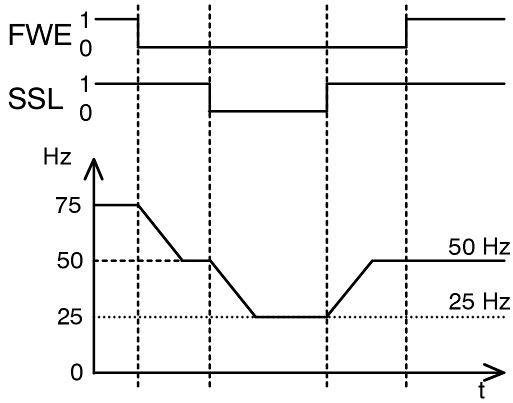
In the picture at right
f_n = 50Hz, f_{max} = 75Hz and f_{SSL} = 25Hz



EP-mode

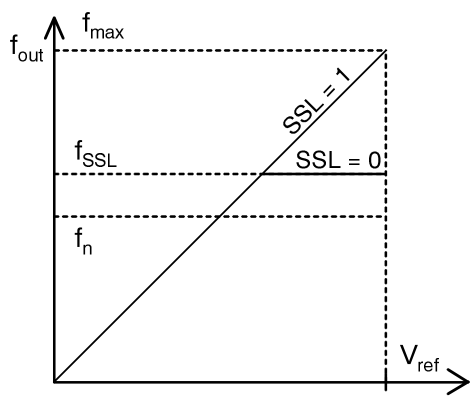
In PO-, AU- and MS-modes when second speed limit is active (SSL-signal is off) the maximum output frequency is limited. The second speed limit can be switched on or off during run.

In the picture at right
f_n = 50Hz, f_{max} = 75Hz and f_{SSL} = 25Hz



The second speed limit can be switched on and off during run

The picture at right shows output frequency f_{out} as a function of the speed reference V_{ref} in PO- and AU-modes.



The output frequency as a function of speed reference

1.4 Mechanical brake control

Travelling motors of XL-hoists and SM-trolleys have an electromechanical disk brake. The AC-voltage of DynAC brake control output is rectified for DC-coils by a rectifier included in motor. The disk brake is opened and kept open during run by DC-voltage. When there is no voltage present the brake is closed and also kept closed by spring force.

The brake is controlled so that during starting the motor first generates torque and after that the brake is opened. The same applies for stopping; while the brake is being closed, the motor still generates torque. During a direction change, the brake is kept open all the time. DynAC decelerates the motor to a stop according to the set deceleration time when the run command is switched off, so the brake is used only as a holding brake. This way brake wear is minimized. Only if a failure occurs or the emergency stop button is pushed, the brake closes immediately stopping the motor and the load.

DynAC 2.2F-45F, 2.2J - 45J, 2.2K - 75K models include an AC-supply from two phases for the disk brake control. DynAC controls this line and it is protected by an adjustable circuit breaker (max.4.0A).

DynAC 55F-800F, 30K-630K models include also a 3-phase AC-supply for the brake control. DynAC controls this line and it is protected by an adjustable circuit breaker (max.4.0A). When a shoe brake is used, brake closing is speeded up by capacitors. They are connected in parallel with the brake via the brake contactor NC-contacts. The connection is partially ready in DynAC. Only the capacitors must be added outside DynAC. This connection can also be used to control KA372B brake control unit, but external control voltage for the KA372B is needed.

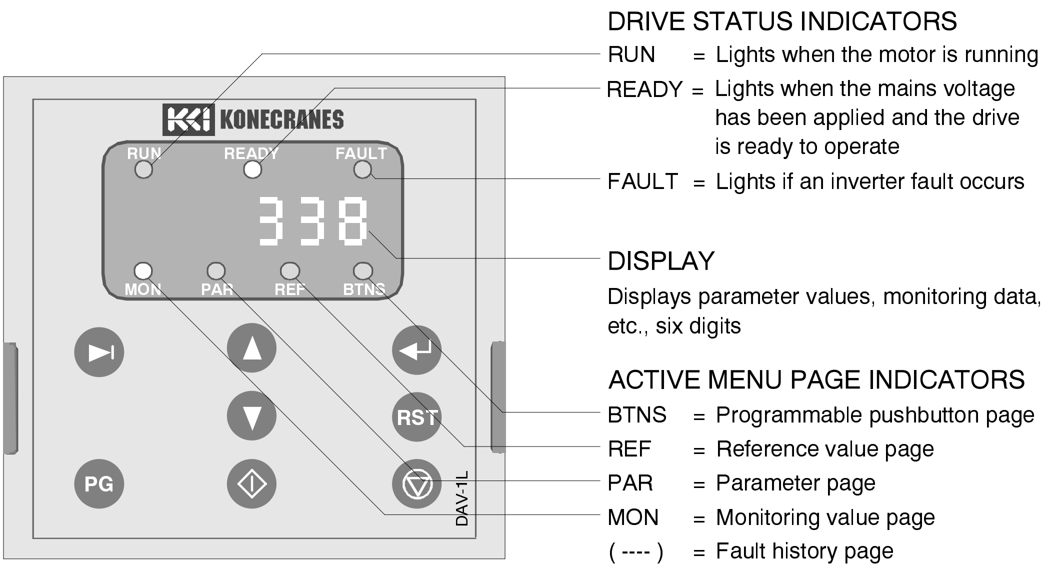
2 PROGRAMMING OF DYNAC

DynAC has a digital control panel including a keyboard and a display. The standard control panel has a 6-digit LED display. As an option, a graphical display panel is also available.

The graphical display panel and the LED display panel are fully interchangeable, as they have compatible interfaces and housings. Both panels are removable and have full galvanic isolation from mains potential. The same panels can be used in all DynAC Vector and DynAHoist Vector frequency converters.

2.1 LED display panel

The LED display panel has a 6-digit LED-display, three drive status indicators, four active menu page indicators and eight pushbuttons for programming and monitoring.



Control panel with LED-display

2.1.1 How to use the LED display keyboard

= *Tabulator button:*
Toggles between display item indication and item data

= *Arrow up/down buttons:*
Changes the item or data value

= *Enter button:*
Confirms the parameter value setting. Fast jump button from one parameter group to the next. Acts as the pushbutton on programmable pushbutton page (BTNS).

RST = *Reset button:*
Not used for any function

PG = *Page button:*
Changes active menu page

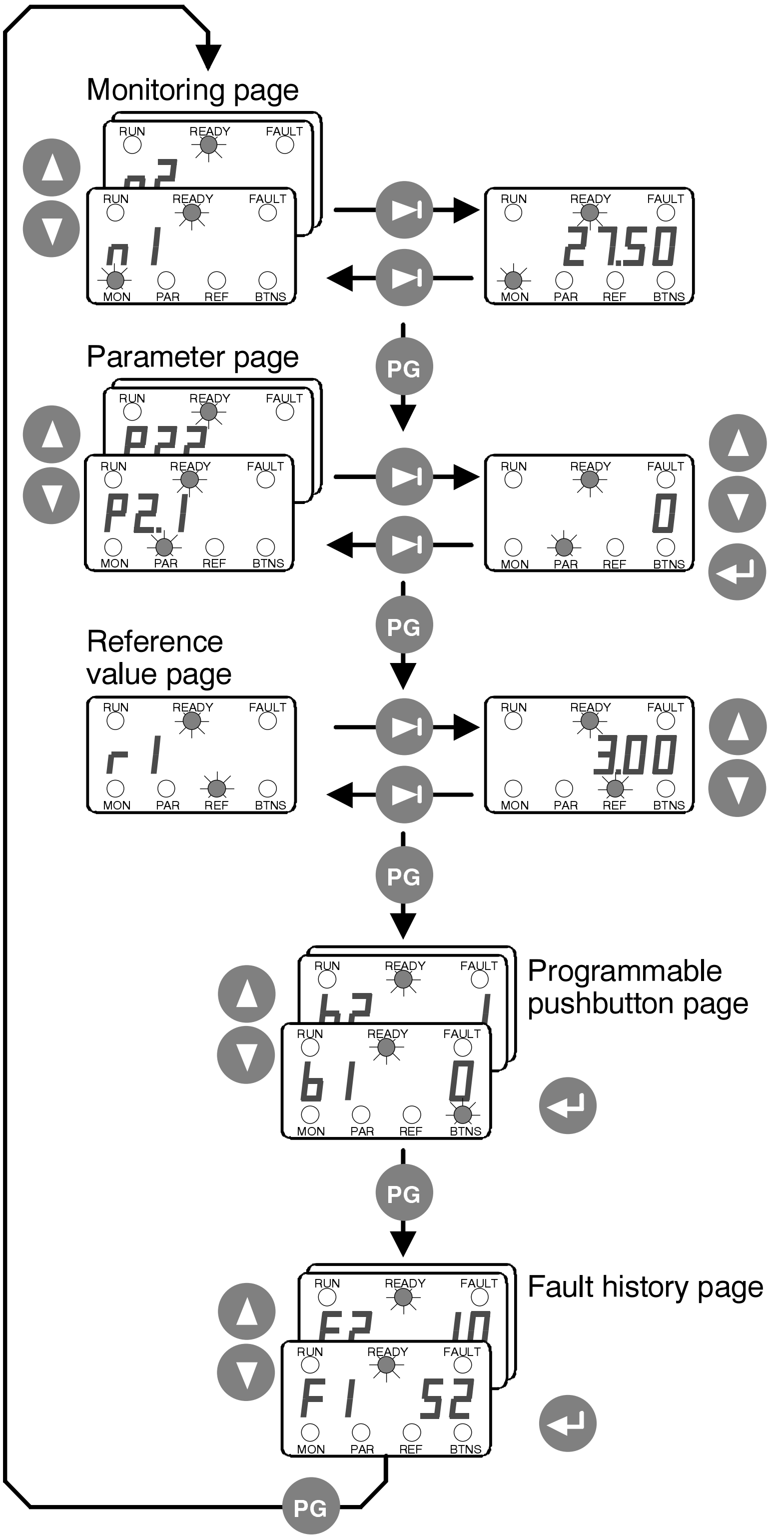
= *Start button:*
Starts the motor if the panel is the active control location

= *Stop button:*
Stops the motor if the panel is the active control location

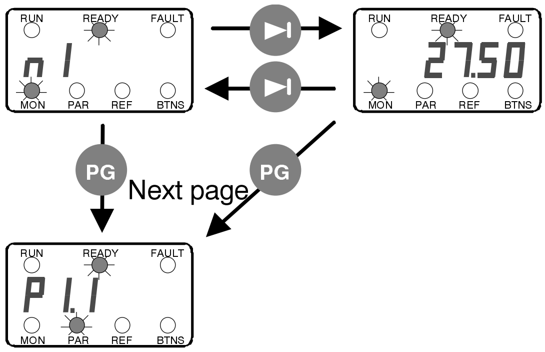
2.1.2 Panel operation

The panel operation is organized in page type menus. There are five different menu pages for monitoring, parameter settings, references, programmable pushbutton functions and fault history.

Active menu page LEDs as well as the leftmost character in the six-digit read-out indicate which of the pages is active. See the panel menu chart below.



2.1.3 Monitoring page



The MON indicator is lit when the monitoring page is active. In the item display the monitoring is “n” and the next digit is the item number.

The figure beside shows how the monitored data values can be selected for display with the tabulator pushbutton. In the following table all the possible monitored items are listed. All values are updated every 200ms.

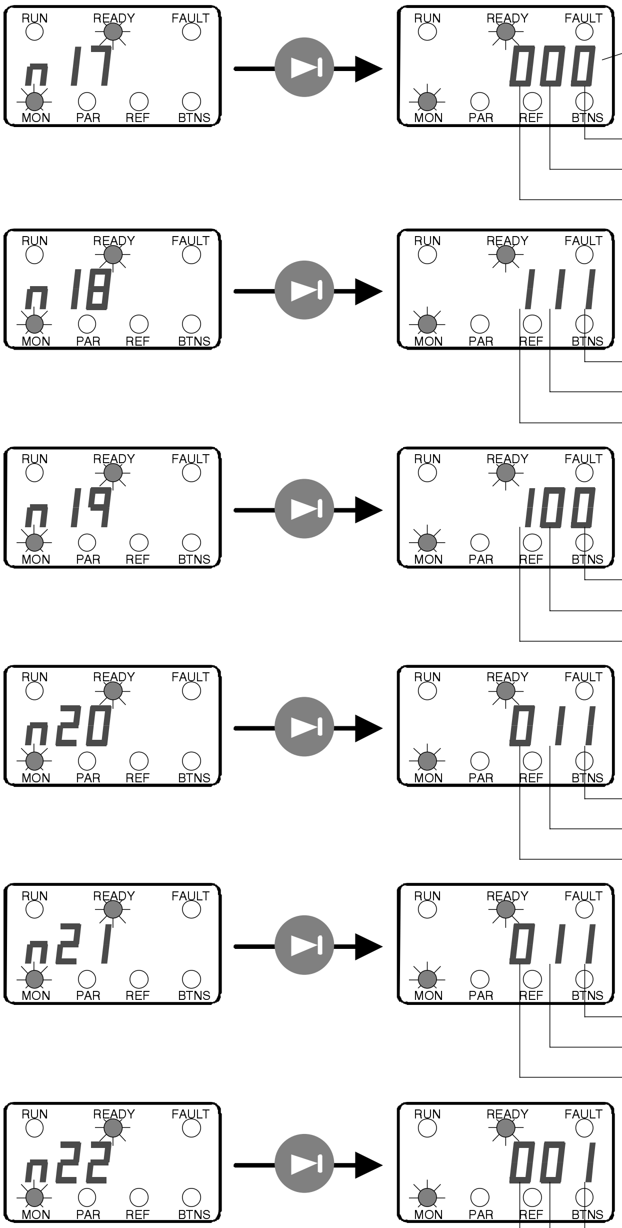
Number	Signal name	Unit	Description		
n 1	Output frequency	Hz	Output frequency to the motor		
n 2	Motor speed	rpm	Calculated motor speed with open loop and measured motor speed with closed loop (encoder)		
n 3	Motor current	A	Measured motor current		
n 4	Motor torque	%	Calculated actual torque / nominal torque of the unit		
n 5	Motor power	%	Calculated actual power / nominal power of the unit		
n 6	Motor voltage	V	Calculated motor voltage		
n 7	DC-bus voltage	V	Measured DC-bus voltage (DC-link = DC-bus)		
n 8	Temperature	°C	Temperature of heat sink		
n 9	Power on day counter	PP.pp	Operating days [1], no resetting		
n 10	Motor run time hours, "trip counter"	HH.hh	Operating hours [2], can be reset with programmable button #3		
n 11	MWh-counter	MWh	Total MW-hours, no resetting		
n 12	MWh-counter, "trip counter"	MWh	Total MW-hours, can be reset with programmable button #4		
n 13	Voltage analog input	V	Ain1 = MS		
n 14	Voltage analog input	V	Ain2 = AS		
n 15	Voltage analog input	V	Ain11 (not used in DynAC) [3]		
n 16	Voltage analog input	V	Ain12 = KR [3]		
n 17	Digital input status, DIA		DIA3 = FWE	DIA2 = S2	DIA1 = S1
n 18	Digital input status, DIB		DIB6 = OK	DIB5 = S22	DIB4 = S12
n 19	Digital and relay output status		DO1 = RBC	RO2 = K1	RO1 = K7
n 20	Digital input status, DIC		DIC13 = MFI [3]	DIC12 = AP	DIC11 = CMS
n 21	Digital input status, DIC		— (not used)	DIC15 = S21 [3]	DIC14 = S11
n 22	Relay output status		RO13 = MRO [4]	RO12 = READY	RO11 = (free) [4]
n 23	Control program version		Version number of the control software		
n 24	Unit nominal power	kW	Power rating of the inverter		
n 25	Motor heating	%	100% = motor temperature increased up to nominal		
n 26	Start counter		n x 100 for total operating time, non-resettable		
n 27	Start counter, “trip counter”		Can be reset with programmable button #5, maximum display value 32000.		
n 28	Distance counter		Calculates the number of motor revolutions after slowdown limit. Operates within slowdown limit area. Not operating, if parameter P5.2 setting value is “0”.		
n 29	Frequency reference	Hz	Frequency reference to inverter		
n 30	Control bus state		Active control location and Profibus status (Ctrl.Bus)		
			Ctrl = 0: Terminal control	Bus = 0: Bus not active	
			Ctrl = 1: Panel control	Bus = 1: Configuration	
			Ctrl = 2: Bus control	Bus = 2: Bus active	

1) PP = full days, pp = decimal part of a day
2) HH = full hours, hh = decimal part of an hour
3) operation differs in profibus (U) models
4) not in expander (P) and profibus (U) models

Digital inputs and outputs status indication

The status of inverter's digital inputs and outputs can be easily checked by monitoring items n17 - n22. Below is shown an example situation of the monitoring items, where

– line contactor is energized	RO2
– drive is not running	RO1, RBC (RUN-indicator is off)
– ready to start and no faults	DIB6, RO11 (FAULT-indicator is off)
– PO-mode selected	DIC11, DIC12
– no direction commands	DIA1, DIA2
– limit switches are closed	DIB4, DIB5, DIC14, DIC15



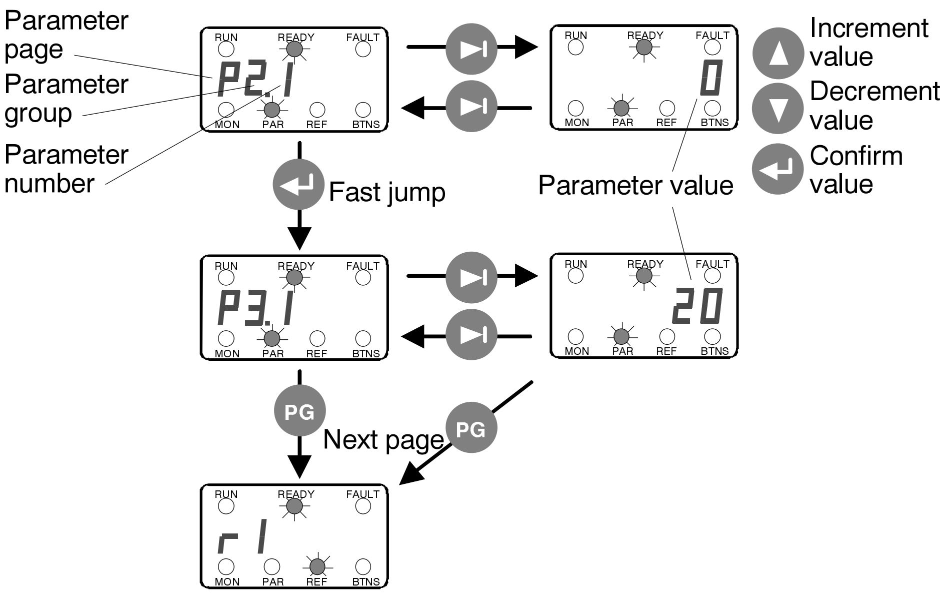
0 = open (RO2=closed)
1 = closed (RO2=open)

Input			Terminal
DIA1	S1	open	A1: 8
DIA2	S2	open	A1: 9
DIA3	FWE	open	A1: 10
DIB4	S12	closed	A1: 14
DIB5	S22	closed	A1: 15
DIB6	OK	closed	A1: 16
RO1	K7	open	A1: 22-23
RO2	K1	closed	A1: 24-25
DO1	RBC	closed	A1: 20
DIC11	CMS	closed	A2: 9
DIC12	AP	closed	A2: 10
DIC13	MFI	open	A2: 11
DIC14	S11	closed	A2: 12
DIC15	S21	closed	A2: 13
not used			
RO11	free	open	A2: 23-24
RO12	READY	closed	A2: 25-26
RO13	MRO	open	A2: 27-28

2.1.4 Parameter page

The PAR indicator is lit when the Parameter page is active. The enter button confirms the change of the parameter value. When the new value is confirmed the PAR indicator blinks once. If the enter button is not pressed the parameter value will not be changed.

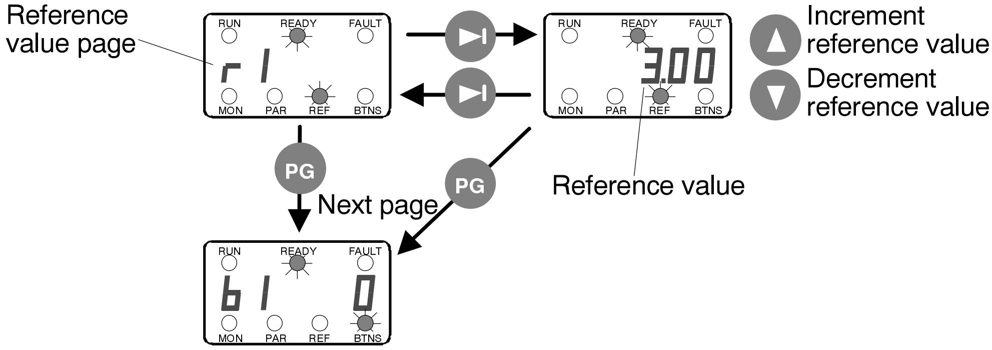
The parameter page contains several parameter groups. Parameters of the groups follow each other and scrolling from the last parameter of one group to the first parameter of the next group or vice versa is done simply by pushing arrow up / arrow down buttons. Fast jump from one group to the next group is done by enter button.



2.1.5 Reference page

The reference page is active when the REF indicator is lit. If the control panel is the active control location, the frequency reference can be changed by changing the value on the display with arrow up/arrow down pushbuttons.

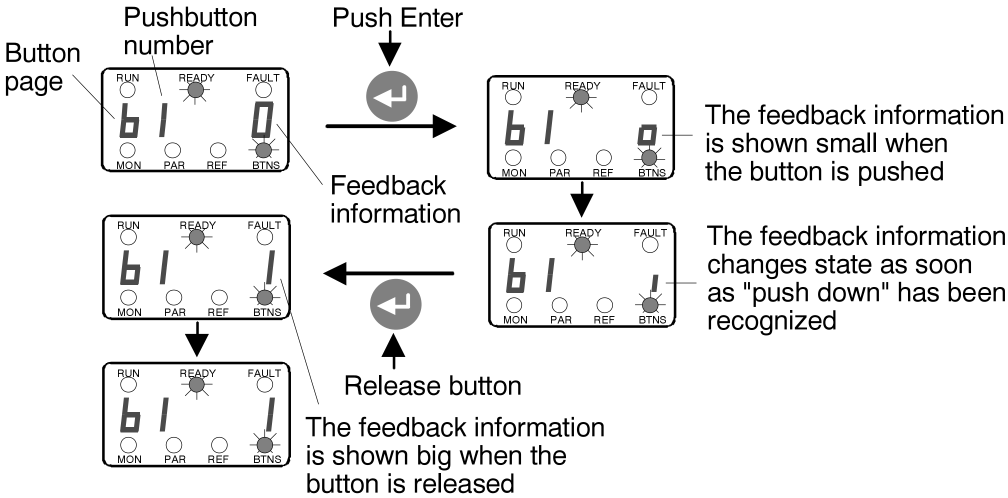
Warning!	**The reference change is effective immediately, without pushing the enter button. The motor speed changes as fast as the reference changes. Do not change the reference during driving to avoid dangerous situations. Avoid driving at high speeds with panel reference!**



2.1.6 Programmable pushbutton page

The BTNS (=buttons) indicator is lit when the programmable pushbutton page is active. One of the five optional functions of the enter button can be selected on this page. The selected function is valid only on this page and on other pages the enter button has its original function. The button operation is impulse type.

Feedback information gives the state of the button function. When the button is pressed, feedback information is shown with small symbol. When the button is released, the feedback information symbol changes to big.



Programmable pushbuttons

Number	Name	Function	Feedback information 0	Feedback information 1
b 1	Reverse	Changes the direction of motor rotation. Active only if the panel is the active control location	Direction command forward	Direction command reverse
			Feedback information flashes as long as actual direction is different from the command while ramping	
b 2	Active control location	Select panel or terminals as the active control location	Control via terminals	Control from the front display panel
b 3	Clear operating hour counter	When pressed, clears the operating hour trip counter	Not cleared	Clears operating hour counter (trip counter)
b 4	Clear MWh counter	When pressed, clears the MWh trip counter	Not cleared	Clears MWh counter (trip counter)
b 5	Clear start counter	When pressed, clears the start trip counter	Not cleared	Clears start counter (trip counter)

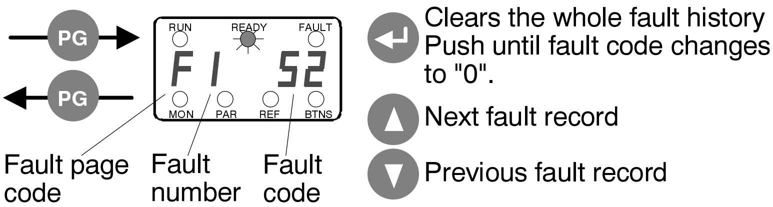
Controlling motor from the display panel

The active control location can be changed with programmable pushbutton b2. Then the motor can be started (START-button) and stopped (STOP-button) from the panel. Rotation direction can also be changed from the panel by programmable pushbutton b1. The motor speed can be adjusted from the reference page.

Warning! Driving via the display panel must be done especially carefully as the external limit switches etc. do not necessarily stop the motion.

2.1.7 Fault history page

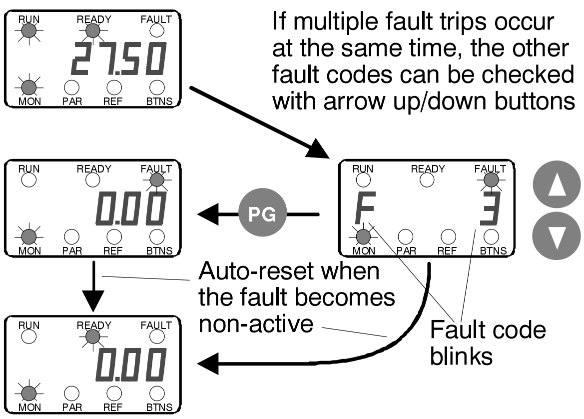
When none of the indicators is lit, the fault history page is active. The inverter stores a maximum of 9 faults in the order they appear. The latest fault is always number 1, the second last is 2 and so on. If 9 uncleared faults are in the memory, the next fault occurrence pushes the oldest fault record out of the memory. The whole fault history page can be cleared by pushing the ENTER-button a few seconds.



2.1.8 Active fault display

When a fault trip occurs, the FAULT indicator is turned on and the blinking fault code “F xx” appears on the display. The fault codes are explained in the chapter “Troubleshooting”.

The display can be cleared with the page button (PG). The display returns to the same display it had before the trip. The FAULT indicator remains on until the fault becomes non-active or is cleared with the external reset signal from the terminals.



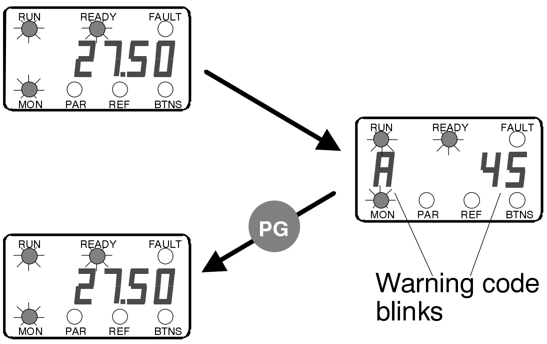
2.1.9 Active warning display

When a warning occurs a blinking warning code "A xx" appears on the display. Warning codes are explained in the table below.

The display can be cleared with the page button (PG). The display returns to the same state it had before the warning (the warning will be automatically cleared after 1 minute). If the cause of the warning stays active, a new warning is not given within 1 minute.

Warning codes:

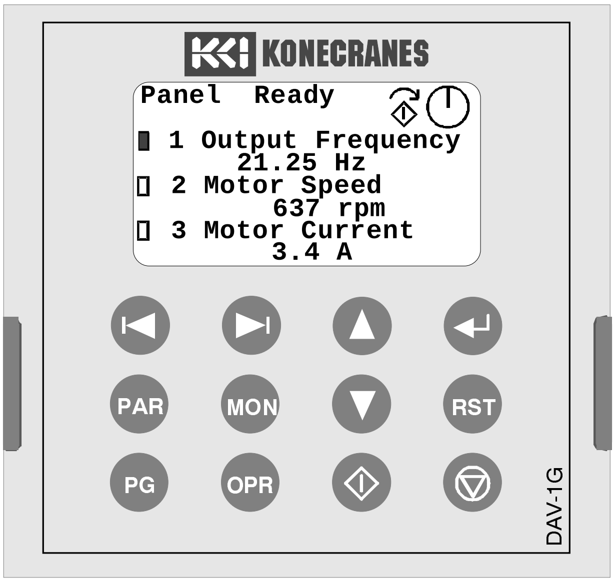
Code	Warning	Checking
A 24	The values in the Fault history, MWh-counters or operating day/hour counters might have been changed during the previous mains interrupt	No action required. Beware, these values may be unreliable.
A 28	The change of an application has failed	Choose the application again and push ENTER-button.
A 29	Expansion board thermistor input has detected motor overtemperature	Check motor cooling and loading. Check thermistor connection. Check parameters. Check the brake opens.
A 30	Motor phase currents unbalanced (only in models 110F-800F, 90K-630K)	Check motor and transistors. Check encoder connections.
A 45	Heat sink overtemperature warning, temperature more than +70°C (158°F)	Check the inverter cooling air flow and the ambient temperature.
A 46	Reference value warning, analog input signal is out of selected range, 1-9V or 2-10V or 4-20mA (can be activated with parameter P15.2)	Check reference value source and cabling.



2.2 Graphical display panel

The data identification of the graphical display panel is shown with clear text. Functionality is similar to the standard LED-panel.

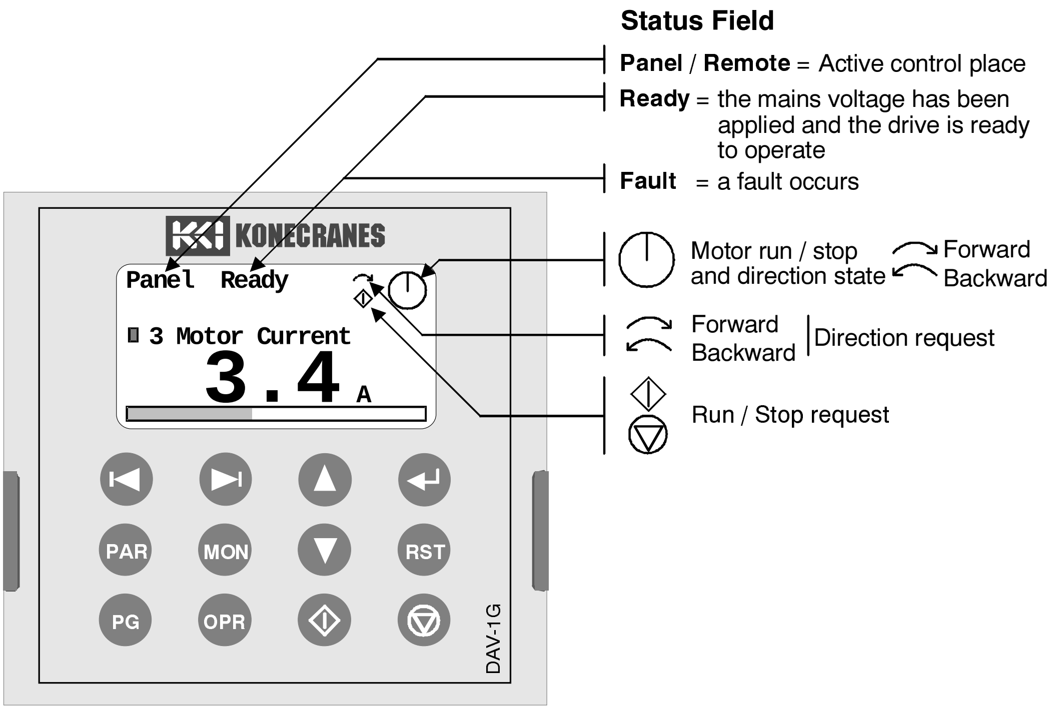
Full graphic display
- 128 x 64 dot matrix
- 8 rows
- 21 characters per row



Several pages for selections and monitoring
- page selection page
- monitoring page
- operating page
- parameter page
- actual values page
- trend page
- trend menu page
- active faults page
- fault history page
- contrast page
- info/files page

The trend page acts as a three channel oscilloscope.

Parameters can be uploaded to the panel and downloaded to the inverter.
- it is possible to copy parameter values from one DynAC unit to another (the units must be same power class and they must have same program version).



2.2.1 How to use the graphical display keyboard

PG = Open page selecting page

PAR = Open parameter page

MON = Open monitoring page

OPR = Open operating page

(Enter) = Enter button
Confirm changes
Open new page
Acts as programmable button
(Enter symbol) = Enter

(Start) = Start button:
Start the motor if the panel is the active control location

(Tabulator) = Tabulator buttons
Move to next or previous item on display
(Empty box) = Selection cursor field
(Dark box) = Dark selection cursor field indicates the selected item

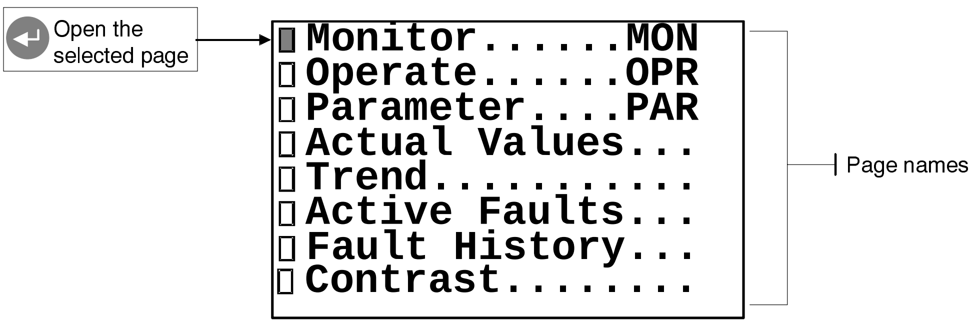
(Arrows) = Arrow up/down buttons:
Change the selected item
(Up arrow box) = Scroll up
(Down arrow box) = Scroll down

RST = Reset button:
Not used for any function

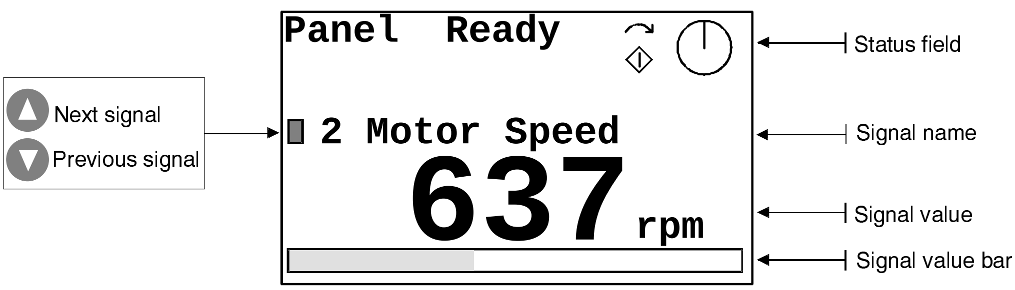
(Stop) = Stop button:
Stop the motor if the panel is the active control location

Warning!	**Driving via the display panel must be done especially carefully as the external limit switches etc. do not necessarily stop the motion.**

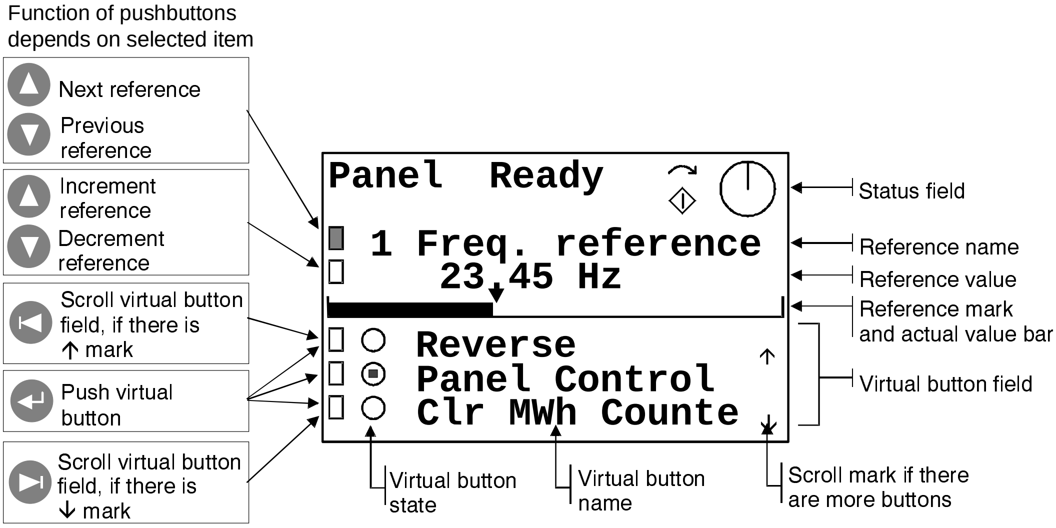
2.2.2 Page selection page



2.2.3 Monitoring page

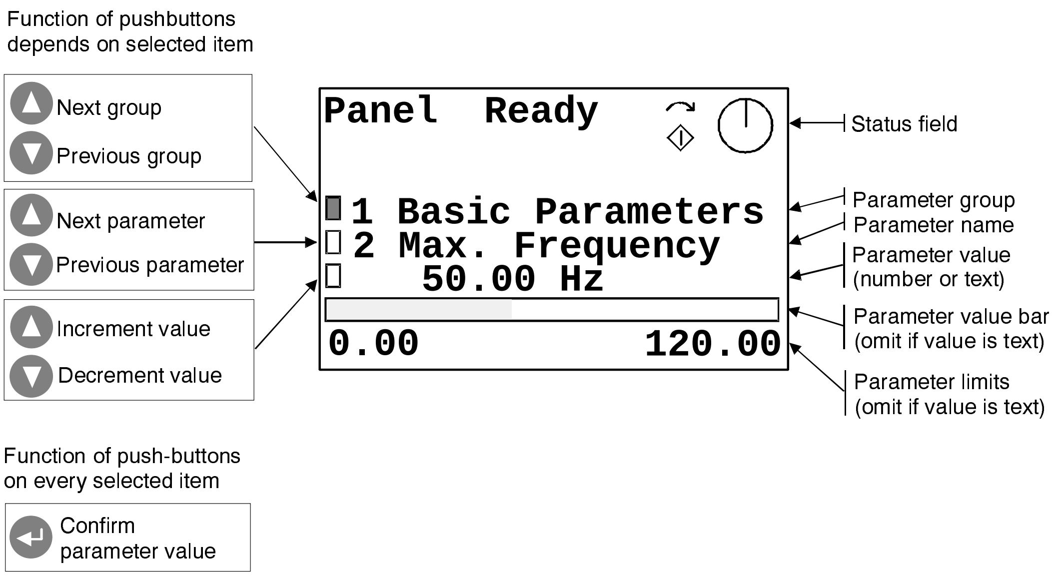


2.2.4 Operating page

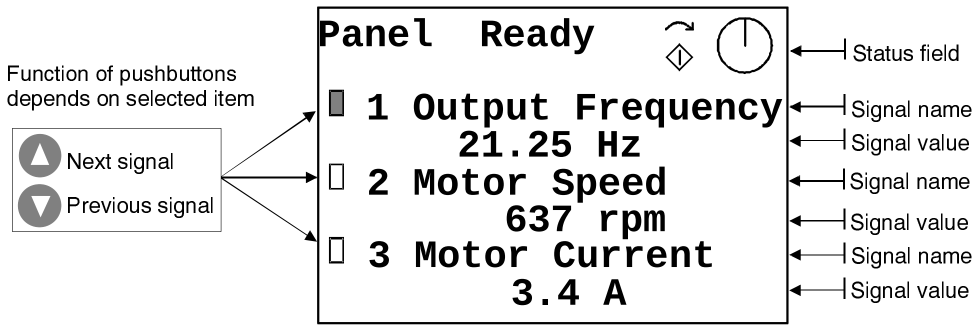


Warning!	**The reference change is effective immediately, without pushing the enter button. The motor speed changes as fast as the reference changes. Do not change the reference during driving to avoid dangerous situations. Avoid driving at high speeds with panel reference!**

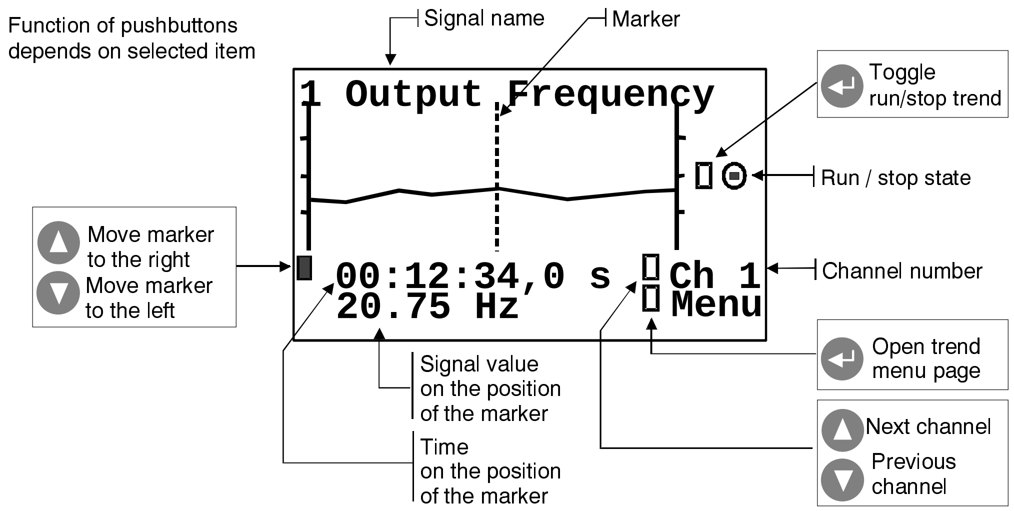
2.2.5 Parameter page



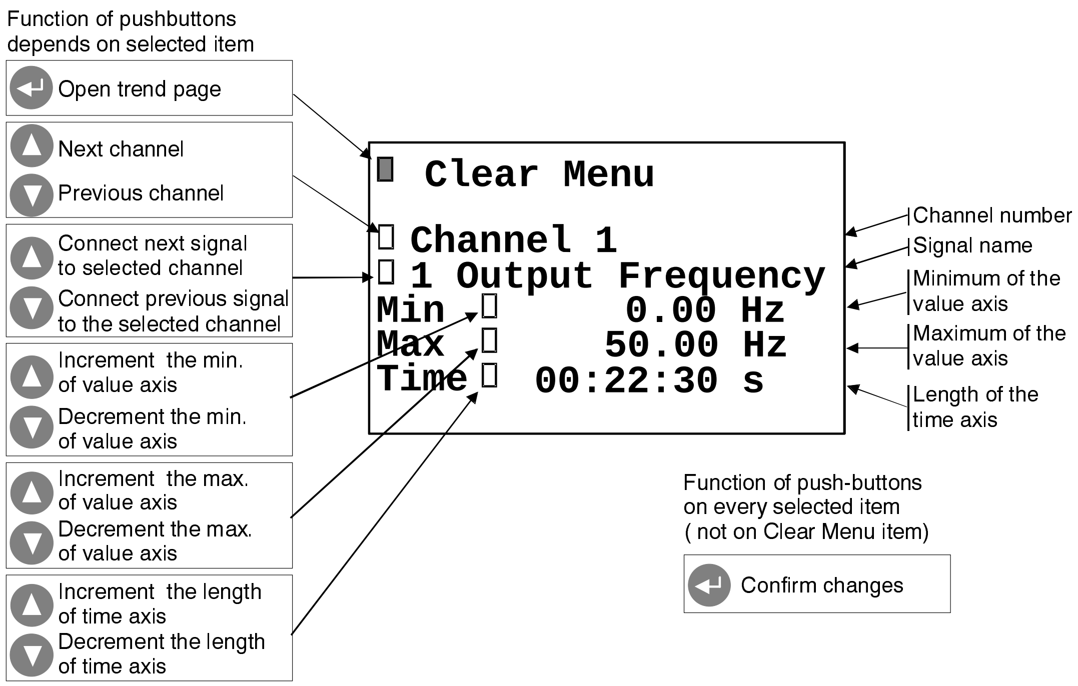
2.2.6 Actual values page



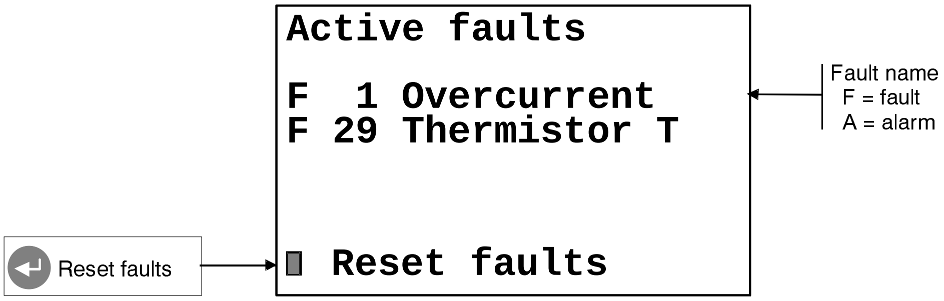
2.2.7 Trend page



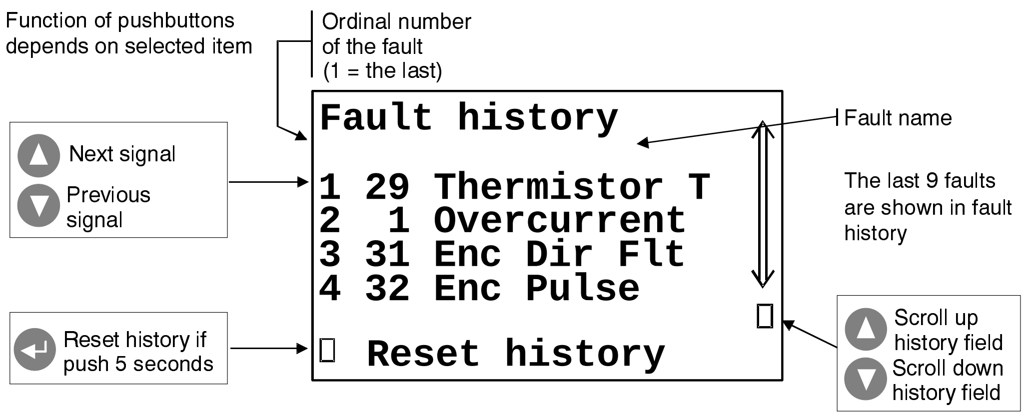
2.2.8 Trend menu page



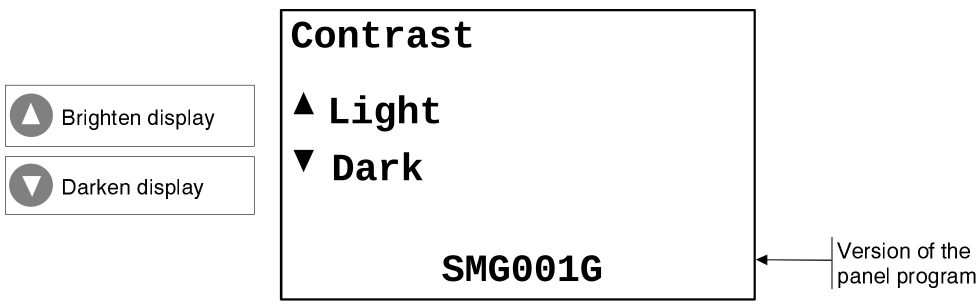
2.2.9 Active faults page



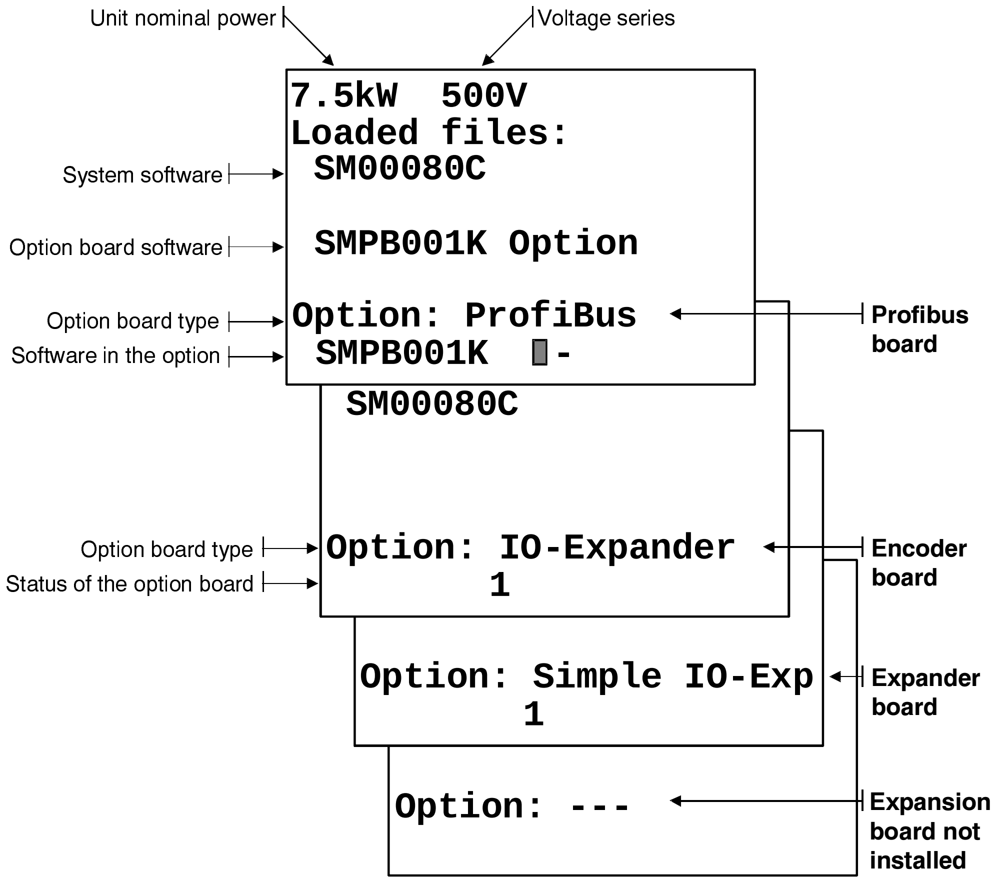
2.2.10 Fault history page



2.2.11 Contrast page



2.2.12 Info/Files page



2.3 Description of parameters

This parameter description is based on the software version 80.03.

For description of parameter group 0, see section 2.3.16.

2.3.1 Parameter group 1; Modified parameters

Pc1.1 Modified parameters
Parameter changes are stored in parameter Pc1.1. Parameter values are compared to factory default values or to user's default values.

2.3.2 Parameter group 2; Basic parameters

P2.1 Parameter conceal

0	Parameter groups 1-2 visible.	Password 0
1	Parameter groups 1-8 visible.	Password 16
2	Parameter groups 1-12 visible.	Password 68

There are additionally several parameters for device protections and internal control functions etc. These parameters are not needed in normal use and thus they are hidden.

P2.2 Parameter value lock
From program version 80.01 the parameter values are locked by following passwords.

0	Parameter value changes disabled.	Password 0
1	Level 1 open.	Password 6
2	Level 2 open.	Password 12

P2.3 Supply voltage
Parameter defines supply voltage.

J-series	F-series	K-series
6 = 200 V	11 = 380 V	18 = 525 V
7 = 220 V	12 = 400 V	19 = 575 V
8 = 230 V	13 = 415 V	20 = 600 V
9 = 240 V	14 = 440 V	21 = 660 V
	15 = 460 V	22 = 690 V
	16 = 480 V	
	17 = 500 V	

Push enter after changing the parameter value of supply voltage, then wait 1 minute with power on and push enter again to accept the parameter change.

Note! With models 7.5F-45F, switch power off after changing the value of parameter P2.3. Then wait until display is blank before next power-up.

2.3.3 Parameter group 3; Input signal parameters

Digital input selections: P3.1, P3.2, P3.3, P3.4, P3.15, P3.16, P3.17, P3.18 and P3.19

0:	Not Used		
1:	Not Used		
2:	Not Used		
3:	Not Used		
4:	Acc./Dec. Time Selection	open contact	= Acceleration/Deceleration time 1 selected (P6.10/P6.11)
		closed contact	= Acceleration/Deceleration time 2 selected (P12.3/P12.4)
5:	Not Used		
6:	Not Used		
7:	Not Used		
8:	Not Used		
9:	Not Used		
10:	AP-control	closed contact	= Acceleration command, see section 1.3 ”Control methods”
11:	CMS-control	closed contact	= Control Mode Selection, see section 1.3 ”Control methods”
12:	MP-control	closed contact	= Multistep selected
		open contact	= Potentiometer control selected
13:	MA-control	closed contact	= Multistep selected
		open contact	= Automation control selected
14:	Slowdown Limit Forward (S11)	open contact	= Slowdown limit forward (S11), see parameter P5.1
15:	Slowdown Limit Reverse (S21)	open contact	= Slowdown limit reverse (S21), see parameter P5.1
16:	End Limit Forward (S12)	open contact	= Stop limit forward (S12), see parameters P5.3 and P5.4
17:	End Limit Reverse (S22)	open contact	= Stop limit reverse (S22), see parameters P5.3 and P5.4
18:	Stop/fault Reset (OK)	closed contact	= Fault reset
		open contact	= Stop, immediate stop by the mechanical brake
19:	Motor Set 2	closed contact	= Motor parameter set 2 enabled, parameter groups 9, 10 and 11 are active
20:	Field Weakening Enabled (FWE)	closed contact	= Field Weakening enabled, see also parameters P5.6, P6.13 and P6.14
21:	Multistep 2 (MS2)	closed contact	= See P5.9, MSL/MSH/MSC, multistep frequencies are set with parameters P5.10-P5.16
22:	Multistep 3 (MS3)	closed contact	= See P5.9, MSL/MSH/MSC, multistep frequencies are set with parameters P5.10-P5.16
23:	Multistep 4 (MS4)	closed contact	= See P5.9, MSL/MSH/MSC, multistep frequencies are set with parameters P5.10-P5.16
24:	Multistep 5 (MS5)	closed contact	= See P5.9, MSL/MSH, multistep frequencies are set with parameters P5.10-P5.16
25:	Ramp 2 + Torque Limit	closed contact	= Selections 4 and 31
26:	Not Used		
27:	EP-hold	closed contact	= Hold speed command in 3-step mode, see section 1.3 ”Control methods”
28:	Second Speed Limit	open contact	= Second Speed Limit activated, see parameter P5.7
29:	Error/fault Reset (OK)	closed contact	= Fault reset
		open contact	= Fault. Fault contact (RO2 K1/KO1 control) is opened. Stopping by the mechanical brake.
30:	Alt Control Mode	closed contact	= Alternative control mode selected, see parameter P6.24
31:	Torque Limit	closed contact	= Torque limit activated, see parameter P8.17

P3.1 DIA3 function
Default value 0 (not used).
Reserved for FWE-function. Inverter board terminal 10 (FWE).

P3.2 DIB4 function
Default value 16 (End limit forward). Inverter board terminal 14 (S12).
See parameters P5.3 and P5.4.

P3.3 DIB5 function
Default value 17 (End limit reverse). Inverter board terminal 15 (S22).
See parameters P5.3 and P5.4.

P3.4 DIB6 function
Default value 18 (Stop/Fault reset). Inverter board terminal 16 (OK).

P3.5 A_{in1} function
Default value 1 (PO-control). Inverter board terminal 2 (MS).

0 = Not used
1 = PO-control. Potentiometer control using a joystick controller. Requires a 15V power supply (included in DynAC). Separate amplifier is not needed.
2 = AU-control. Automation control is made for any equipment with output voltage in the range of 0-10V (for example radio-controllers and process computers).
3 = Torque reference
4 = Not used
5 = Frequency bias (Function activated by setting P6.25=1)

P3.6 A_{in1} signal range
Default value 0 (0-10 V)

0 = signal range 0-10 V
1 = signal range 2-10 V
2 = signal range -10-+10 V
3 = signal range 1-9 V

(Gain=100 %; Bias=0 %).

Ain	Signal (0-10V)	Signal (2-10V)	Signal (-10-10V)	Signal (1-9V)
0 V	0%	0% / Fault	0%	0% / Fault
1 V	10 %	0%	10 %	0%
2 V	20 %	0%	20 %	12,5 %
3 V	30 %	12,5 %	30 %	25 %
:	:	:	:	:
8 V	80 %	75 %	80 %	87,5 %
9 V	90 %	87,5 %	90 %	100 %
10 V	100 %	100 %	100 %	100 %

P3.7 A_{in1} signal filter time
Default value 0.10 s.
Filters out disturbances from the incoming analog A_{in1} signal.

P3.8 **A_{in1} scaling bias**
Default value 300.0 %.
Defines input signal bias value.

P3.9 **A_{in1} scaling gain**
Default value -300.0 %.
Scaling gain defines input signal scaling range.

$$Signal = Gain \times Ain + Bias$$

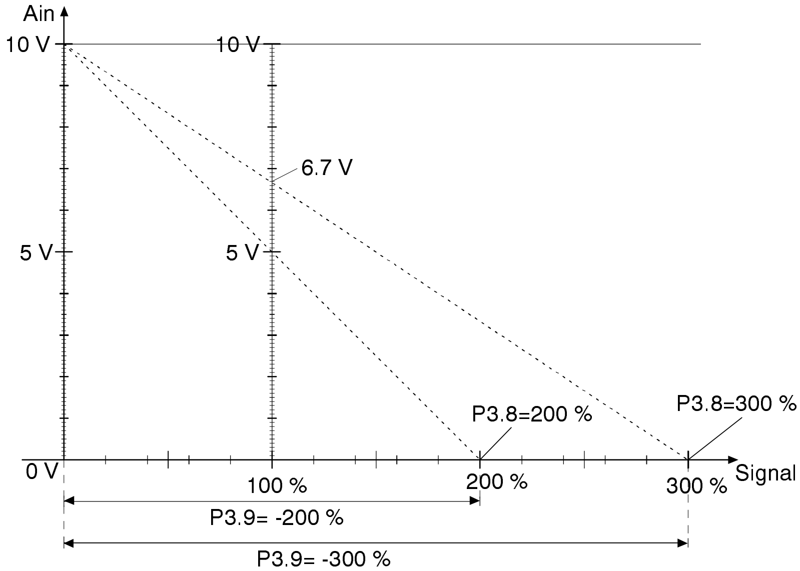


Figure 1: Scaling of analog input signal.

Tuning of the analog input in PO-control: Voltage range (*ΔV*) in examples is 0-10 V.
PO-control:

$$Gain = \frac{100\ \%}{(Ain\ /\ \Delta V\ -1)}$$

Bias=-Gain

A_{in} is replaced with the potentiometer minimum voltage

Example 1: minimum voltage = 6.7 V (=67%)

$$Gain = \frac{100\ \%}{(6{,}7\ V\ /\ 10\ V\ -1)} \approx -300\ \%$$

Bias=300 %

Example 2: minimum voltage = 5.0 V (=50%)

$$Gain = \frac{100\ \%}{(5{,}0\ V\ /\ 10\ V\ -1)} \approx -200\ \%$$

Bias=200 %

P3.10 A_{in2} function

Default value 2 (AU-control). Inverter board terminal 4 (AS).

Selections are same as in parameter P3.5.

P3.11 A_{in2} signal range

Default value 0 (0-10 V)

0 = signal range 0-10 V
1 = signal range 2-10 V
2 = signal range 1-9 V

P3.12 A_{in2} signal filter time

Default value 0.10 s.

Filters out disturbances from the incoming analog A_{in2} signal.

P3.13 A_{in2} scaling bias

Default value 0.0 %.

Defines input signal bias value.

P3.14 A_{in2} scaling gain

Default value 100.0 %.

Scaling gain defines input signal scaling range.

$$Signal = Gain \times Ain + Bias$$

A_{in2} is normally used to AU-control P3.10 selection 2.

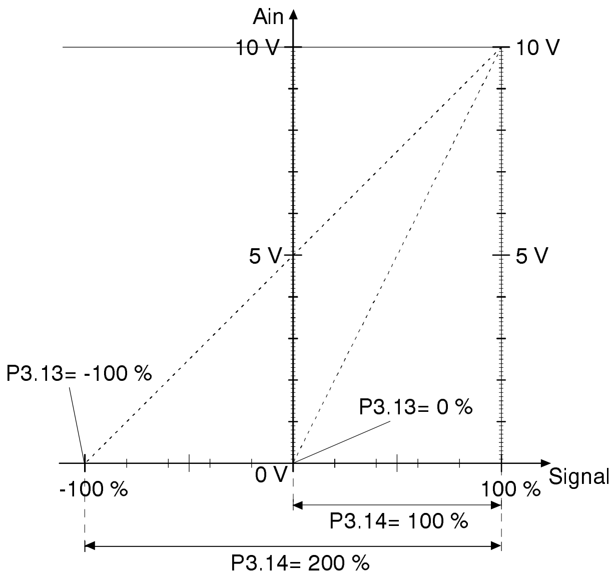


Figure 2: Scaling of analog input signal.

P3.15 DIC11 function

Default value 11 (CMS-control). Encoder/Expander board terminal 9 (CMS).

P3.16 DIC12 function

Default value 10 (AP-control). Encoder/Expander board terminal 10 (AP).

P3.17 DIC13 function

Default value 0 (Not used). Encoder/Expander board terminal 11 (MFI).

P3.18 DIC14 function

Default value 14 (Slowdown limit forward). Encoder/Expander board terminal 12 (S11).

See parameters P5.1 and P5.2.

P3.19 DIC15 function

Default value 15. (Slowdown limit reverse). Encoder/Expander board terminal 13 (S21).

See parameters P5.1 and P5.2.

P3.20 **A_{in11} function**
Default value 0 (Not used). Encoder board only, terminal 2.
Selections are same as in parameter P3.5.

P3.21 **A_{in11} signal range**
Default value 0 (0-10 V)
0 = signal range 0-10 V
1 = signal range 2-10 V
2 = signal range -10-+10 V
3 = signal range 1-9 V

P3.22 **A_{in11} filter time**
Default value 0.10 s.
Filters out disturbances from the incoming analog A_{in11} signal.

P3.23 **A_{in11} scaling bias**
Default value 0.0 %.
Defines input signal bias value.

P3.24 **A_{in11} scaling gain**
Default value 100.0 %.
Scaling gain defines input signal scaling range.

$$Signal = Gain \times Ain + Bias$$

A_{in11} is not used in DynAC.

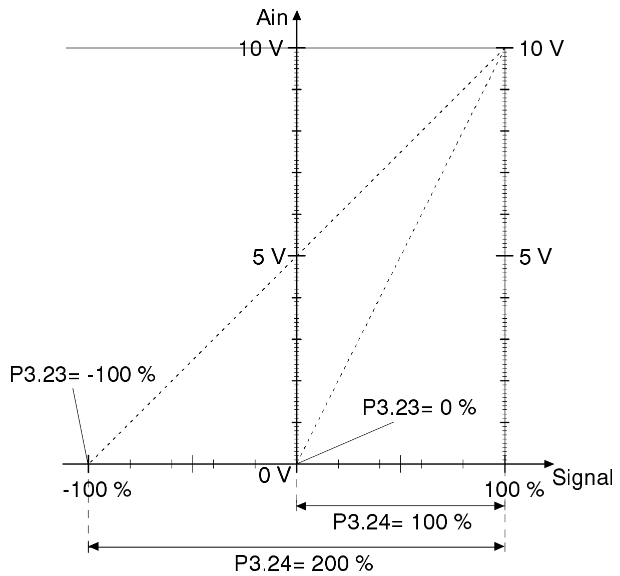


Figure 3: Scaling of analog input signal.

P3.25 **A_{in12} function**
Default value 0 (Not used). Encoder board only, terminal 4 (KR).
Selections are same as in parameter P3.5.

P3.26 **A_{in12} signal range**
Default value 0 (0-10 V)
0 = signal range 0-10 V
1 = signal range 2-10 V
2 = signal range -10-+10 V
3 = signal range 1-9 V

Note!	**Selection of the signal range affects selection of the scaling gain.**

P3.27 **A_{in12} filter time**
Default value 0.10 s.
Filters out disturbance from the incoming analog A_{in12} signal.

P3.28 **A_{in12} scaling bias**
Default value 0.0 %.
Defines input signal bias value.

P3.29 **A_{in12} scaling gain**
Default value 100.0 %.
Scaling gain defines input signal scaling range.

$$Signal = Gain \times Ain + Bias$$

When analog input A_{in12} is used it is usually used as correction signal in DynAC (P3.25 selection 5).

$$Gain = \frac{Signal}{(Ain / \Delta Ain - 0.5)}$$

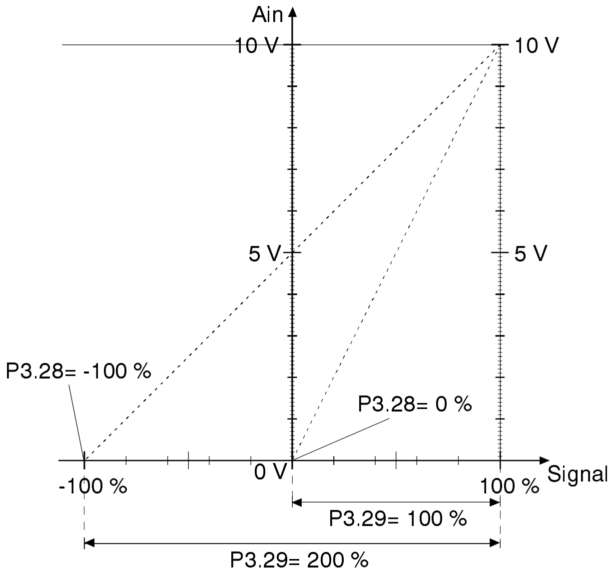


Figure 4: Scaling of analog input signal.

Signal range	0-10V	2-10V	-10-10V	1-9V
ΔA_{in}	10	8	10	8

Example:
In frequency bias, a 100% correction is equivalent to 10 Hz correction. From the table below you can see maximum correction with different selections. Selection of the signal range P3.26 also affects to selection of parameters P3.28 and P3.29. Maximum correction is 10 Hz.

Gain (0-10 V)	*Bias*	Correction
200 %	-100 %	±10 Hz
100 %	-50 %	±5 Hz
50 %	-25 %	±2.5 Hz

2.3.4 Parameter group 4; Output signal parameters

Digital and relay output selections: P4.1, P4.2, P4.3, P4.7, P4.8 and P4.9

Nr		Setting value	Signal content Digital output DO1 is conductive and programmable relay outputs (RO1, RO2, RO11, RO12, RO13) are active when:
0	=	Not used	
1	=	Ready	The inverter is ready to operate. Default value in relay output RO12 (READY) P4.8.
2	=	Run	The inverter operates (motor is running)
3	=	Fault	A fault trip has occurred. Default value in relay output RO2 (K1/K01 control) P4.3.
4	=	Fault inverted	The output is active when a fault trip has not occurred.
5	=	Inverter overheat warning	The heat-sink temperature exceeds +70°C (158°F).
6	=	Not used	
7	=	Ref. fault or warning	Fault or warning depending on the parameter P15.2 if the signal is outside of the selected range (selections 2-10V, 1-9V, 4-20mA).
8	=	Warning	Always if warning exists.
9	=	Not used	
10	=	Not used	
11	=	Not used	
12	=	Not used	
13	=	Not used	
14	=	Not used	
15	=	Not used	
16	=	Not used	
17	=	External brake control	External brake ON/OFF- control. Brake control delay P6.18. Default value in relay output RO1 (K7 control) P4.2.
18	=	Not used	
19	=	Temp > 20°C	Heat sink temperature above 20°C (68°F).
20	=	Not used	
21	=	RBC	Non zero speed. Default value in digital output DO1 (RBC) P4.1.
22	=	Fan control	External fan control. Fan off delay P5.5.
23	=	Not Ready	Inverter is not Ready to operate.

P4.1 Digital output DO1 content
Default value 21 (RBC). Inverter board terminal 20 (RBC).

P4.2 Relay output RO1 content (U=250 VAC; I_{rms} =2 A)
Default value 17 (External brake control). Inverter board terminals 22 and 23 (K7 control). Closing contact.

Note!	**Connected to K7 in DynAC. Setting must not be changed.**

P4.3 Relay output RO2 content (U=250 VAC; I_{rms} =2 A)
Default value 3 (Fault). Inverter board terminals 24 and 25 (K1/K01 control). Opening contact.

Note!	**Connected to K1 in DynAC. Setting must not be changed.**

P4.4 Analog output A_{out1} content
Default value 1 (Motor frequency). Inverter board terminal 18 (FRS).
There are 8 alternatives in parameter P4.4 (as P4.10). The scaling bias and gain are defined by parameters P6.26 and P6.27 / P9.26 and 9.27. The signal range of the analog signal A_{out1} is defined by parameter P4.5.

P4.5 A_{out1} signal range
The signal range and sign of A_{out1} are defined by parameter P4.5.

In frequency and speed signals the direction S1 is positive and direction S2 is negative.

0 = signal range 0-20 mA (signed)
1 = signal range 4-20 mA (signed)
2 = signal range 0-20 mA (unsigned)
3 = signal range 4-20 mA (unsigned)

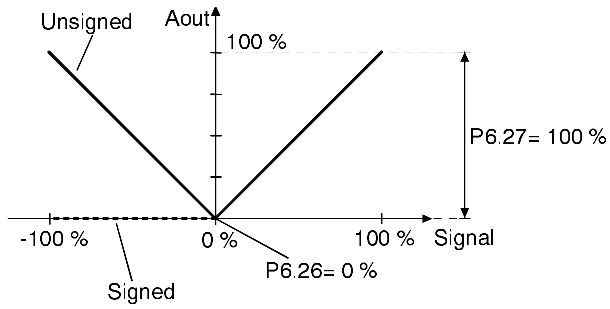


Figure 5: The sign of analog output.

P4.6 Analog output A_{out1} filter time
Filters out disturbances from the analog output signal A_{out1} .

P4.7 RO11 function (U=250 VAC; I_{rms}=2 A)
Default value 0 (Not used). Encoder board only, terminals 23 and 24. Closing contact.

P4.8 RO12 function (U=250 VAC; I_{rms}=2 A)
Default value 1 (Ready). Encoder/Expander board terminals 25 and 26 (READY). Closing contact.

P4.9 RO13 function (U=250 VAC; I_{rms}=2 A)
Default value 0 (Not used). Encoder board only, terminals 27 and 28 (MRO). Closing contact.

P4.10 Analog output A_{out11} content (A_{out})
Default value 0 (Not used). Encoder board only, terminal 20 (Aout).
There are 8 alternatives in parameter P4.10. The scaling bias and gain are defined by parameters P6.28 and P6.29 / P9.28 and 9.29. The signal range of the analog signal A_{out11} is defined by parameter P4.11.

	Function	Range with bias=0% and gain=100%
0	Not used	
1	Motor frequency	0-100 % nominal frequency = P6.2
2	Motor speed	0-100 % maximum speed
3	Motor current	0-200 % of inverter nominal current
4	Motor torque	0-250 % positive when motoring, negative when generating
5	Motor power	0-200 %
6	Motor voltage	0-100 % nominal voltage = P6.1
7	DC-link voltage	0-1500 V
8	Torque 2	0-250 % positive, when torque to direction S1

P4.11 A_{out11} signal range
Default value 0 (0-10 V signed)
The signal range and sign of A_{out11} are defined by parameter P4.11.

In frequency and speed signals the direction S1 is positive and direction S2 is negative.

0 = signal range 0-10 V (signed)
1 = signal range 2-10 V (signed)
2 = signal range 0-10 V (unsigned)
3 = signal range 2-10 V (unsigned)

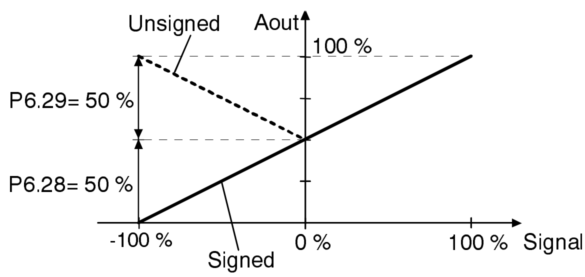


Figure 6: Sign of analog signal.

P4.12 Analog output A_{out11} filter time
Default value 0.00 s.
Filters out disturbances from the analog output signal A_{out11}.

2.3.5 Parameter group 5; Drive control parameters

P5.1 Speed against slow switch

Parameter P5.1 defines frequency limit after slowdown limit (S11/S21). In crane application, slowdown limits are in inputs S11 (DIC14, param. P3.18) and S21 (DIC15, param P3.19).

P5.2 Slow distance

This parameter defines how many revolutions the motor runs after hitting the slowdown limit switch.

- 0 Slow distance is not used. When slowdown limit S11 (S21) opens the speed is limited by the deceleration ramp to the speed defined in parameter P5.1. Slower speeds are also possible. When S11 (S21) is open but S21 (S11) closed the speed in reverse (forward) direction is not limited and the crane may leave the slowdown limit area with maximum speed.
- >0 Slow distance is in use and its function depends on the value of parameter P5.2. When slowdown limit S11 (S21) opens DynAC begins to calculate the distance driven in the slowdown limit area. The limit of the frequency reference forward (reverse) decreases as the distance from the slowdown limit S11 (S21) increases. The upper limit of the frequency reference is at least the frequency defined in parameter P5.1. When S11 (S21) is open but S21 (S11) closed the speed in reverse (forward) direction is not limited and the crane may leave the slowdown limit area with maximum speed. The distance driven in the slowdown limit area is saved in the memory of DynAC even in case of a power failure. DynAC may be driven slower than the calculated frequency limit in all situations. Then the speed of DynAC follows the reference with defined acceleration/deceleration ramp.

Note! **If DynAC is outside the slowdown limit area (S11 and S21 closed) when a power supply blackout occurs and it is in the slowdown limit area when supply returns the calculation of position does not function correctly. The speed limitation does not function correctly if the status of the slowdown limits is changed. To avoid these hazards DynAC must first be driven out of the slowdown limit area.**

Setting

The set value of parameter P5.2 = number of motor shaft revolutions when the crane is driven through the slowdown limit area. If the same rate of deceleration as with the normal deceleration ramp is desired the value is calculated in the following manner.

$$P5.2 = \frac{P6.11}{2} \times \frac{P6.3}{60}$$

Example P6.11=3.0 s; P6.3=1000 rpm

$$P5.2 = \frac{3}{2} \times \frac{1000}{60} = 25 \text{ revolutions}$$

P5.3 End stop restart delay

Parameter P5.3 defines the restart delay after opening of the end stop limit switch. This function ensures stopping of motion before driving continues.

P5.4 End stop input function (S12 / S22)

Default value 1. Selection must not be changed if end stop is in use.

In crane application end stops are programmed to inputs S12 (DIB4, parameter P3.2) and S22 (DIB5, parameter P3.3).

0 = Normal, stop according to P6.22.
1 = Brake stop with external brake. The fault relay is not opened.
2 = Fault stop, fault relay (RO2 K1/KO1 control) is opened. Direct stop with external brake.

P5.5 Fan off delay

Default value 300 s.

Parameter P5.5 defines delay time for the brake resistor fans after stopping the inverter. The fans are switched on when the brake chopper turns on.

P5.6 Maximum ESR frequency

Defines maximum frequency to Extended Speed Range (ESR). ESR can be set active by Field Weakening Enabled (FWE) programmed into a digital input terminal X1:53 (see parameter P3.1 selection 20 Field Weakening, see also P5.7). ESR can be set active only when DynAC is stopped. If the enabling is switched off during run the maximum frequency is the one defined in P6.7. ESR is active when signal is "1".

P5.7 Second Speed Limit (SSL)

The output frequency can be limited to a desired maximum value. This Second Speed Limit can be switched on during run. The value of the Second Speed Limit can be lower or higher than the frequency in parameter P6.7. The Second Speed Limit is active when signal is "0". See table below.

The Second Speed Limit can be programmed into a digital input (see digital input selections. Selection 28=Second Speed Limit). If the SSL signal is not programmed into any digital input, this setting has no effect.

SSL	FWE	Maximum frequency
0	0	the lower of f_n (P6.7) and SSL (P5.7)
1	0	f_n (P6.7)
0	1	SSL (P5.7)
1	1	FWE (P5.6)

P5.8 Change reference during run

0 = No. Changing of control method during run disabled.
1 = Yes. Changing of control method during run enabled (EP/PO/AU/MS). For example, during run it is possible to change control mode from AU-control to EP-control if P5.8=1.

P5.9 MS-control logic selection

The speed reference to DynAC can be given also with digital input signals MS2 ... MS5. Depending on the states of these signals, the speed reference is selected from preset values. The function of this multistep (MS) control has further three available types. The MS-type selection is made by parameter P5.9 as shown in the table below.

Value of P5.9	Type of MS-control	number of speed steps
0	MSL L = lowest inactive signal determines reference	max 5
1	MSH H = highest active signal determines reference	max 5
2	MSC C = coded reference	max 8

With standard configuration, there are no hardware inputs assigned for MS-control. The table below indicates the recommended settings for MS-control. For example, setting parameter P3.16 = 21 assigns MS2-function to the hardware input which is connected to terminal X1:17 of the DynAC. This input is labeled "AP", because of the standard setting of P3.16 = 10 corresponding to AP-function.

Input signal	Activation	Terminal	Label	Notes
MS2	P3.16=21	X1:17	AP	
MS3	P3.15=22	X1:18	CMS	
MS4	P3.17=23	X1:54	MFI	
MS5	P3.1=24	X1:53	FWE	not available with MSC

Note! The DynAC can be used in MS-mode only by reassigning some of the digital inputs, because as standard the inputs are programmed for other functions. Two to four inputs (with functions MS2 ... MS5) are required depending on selected MS-type.

When using MS-control, one of the other control methods may be used in the same unit by applying MA/MP/AP functions. MA and MP functions require one additional input for selection.

Using AP function requires also one additional input for acceleration command. Selection between the MS- and AP-commands is possible by setting parameter P5.8 = 1, which allows changing the mode during run.

Note! "Unnecessary" inputs may be assigned for other functions. For example, with a 4-step MSL-type control terminal X1:53 may be used to activate some other needed function (as the MS5-function is not needed).

The multistep control can also be used to make a simple 2-speed function, which in some cases may be required instead of EP-mode.

Note! If CMS-input has not been used, the signal content must be changed to allow the multistep function (e.g. P3.15 = 0).

P5.10 Multistep 2
P5.11 Multistep 3
P5.12 Multistep 4
P5.13 Multistep 5
P5.14 Multistep 6
P5.15 Multistep 7
P5.16 Multistep 8

The speed references corresponding to the states of the input signals are defined by parameters P5.10 ... P5.16. The function of the different MS-types is shown in the tables below.

MSL-type (L= lowest inactive signal determines reference)

States of the input signals (x= don't care)					Speed reference setting	
S1 or S2	MS2	MS3	MS4	MS5	Parameter	Notes
on	off	x	x	x	P6.8 / P6.9	minimum speed direction dependent
on	on	off	x	x	P5.10	step 2
on	on	on	off	x	P5.11	step 3
on	on	on	on	off	P5.12	step 4
on	on	on	on	on	P5.13	step 5, usually equal to max. speed

MSH-type (H= highest active signal determines reference)

States of the input signals (x= don't care)					Speed reference setting	
S1 or S2	MS2	MS3	MS4	MS5	Parameter	Notes
on	off	off	off	off	P6.8 / P6.9	minimum speed direction dependent
on	on	off	off	off	P5.10	step 2
on	x	on	off	off	P5.11	step 3
on	x	x	on	off	P5.12	step 4
on	x	x	x	on	P5.13	step 5, usually equal to max. speed

MSC-type (C= coded reference); MS5 not applicable

States of the input signals					Speed reference setting	
S1 or S2	MS2	MS3	MS4		Parameter	Notes
on	off	off	off		P6.8 / P6.9	minimum speed direction dependent
on	on	off	off		P5.10	step 2
on	off	on	off		P5.11	step 3
on	on	on	off		P5.12	step 4
on	off	off	on		P5.13	step 5
on	on	off	on		P5.14	step 6
on	off	on	on		P5.15	step 7
on	on	on	on		P5.16	step 8, usually equal to max. speed

Recommended speed steps in 3 to 5 step controls are according to following table (note that actual setting is in Hz). In case of coded reference with more than 5 steps, adjust case by case.

		3-step	**4-step**	**5-step**
STEP 1		Minimum speed, typically 5-10%		
STEP 2	P5.10	20-30%	20%	20%
STEP 3	P5.11	100%	50%	35%
STEP 4	P5.12		100%	60%
STEP 5	P5.13			100%

2.3.6 Parameter group 6; Motor parameter set 1

Note!	**The parameters in group 6 are motor specific. In open loop the parameters must be set in start-up according to Appendix A9 “Open loop V/f-adjustment”. In closed loop the parameters must be set in start-up according to Appendix A11 “Closed loop tuning”. Do not change any settings after start-up.**

P6.1 Nominal voltage of the motor
Find setting value U_n from the rating plate of the motor.

Note!	**Setting of this parameter sets the voltage at the field weakening point, parameter P6.14, to the same value. (100% x U_n)**

P6.2 Nominal frequency of the motor
Find setting value f_n from the rating plate of the motor.

Note!	**Setting of this parameter sets the frequency at the field weakening point, parameter P6.13, to the same value.**

P6.3 Nominal speed of the motor
Find setting value n_n from the rating plate of the motor.

P6.4 Nominal current of the motor
Find setting value I_n from the rating plate of the motor.

P6.5 Current limit
Defines the maximum motor current from the inverter. If the output current exceeds the value set in parameter P6.5 the output frequency is lowered until the current drops below the current limit. The rate of lowering the frequency depends on the current overshoot. When the output current goes under the set value, the frequency is again increased according to the acceleration time P6.10/P12.3. To avoid motor overloading, set this parameter according to rated current of the motor (normally 1.5xI_n). The value must be limited to DynAC maximum output current (1 minute value).

P6.6 DC-braking current
Defines the current injected into the motor during the DC braking. The nominal current of the motor is used as the value of the DC-braking current.

P6.7 Maximum frequency
Defines maximum frequency of the inverter in the normal frequency range. A higher speed limit for the ESR-range can be set in parameter P5.6.

P6.8 Minimum frequency forward
Defines minimum frequency(forward) of the inverter.

P6.9 Minimum frequency reverse
Defines minimum frequency(reverse) of the inverter.

P6.10 Acceleration time 1
P6.11 Deceleration time 1
These values correspond to the time required for the output frequency to accelerate from zero to the motor nominal frequency (P6.2).

If ESR is used, the actual acceleration/deceleration times are $\frac{P5.6}{P6.2} \times P6.10\,(P6.11)$.

P6.12 Use intelligent ramps

Intelligent ramps can be activated with parameter P6.12. Parameters for adjustment of the intelligent ramps are in parameter group 12. There are separate ramps available for forward and reverse directions and for stopping and for change of direction.

Setting	Function
0	Acceleration and deceleration ramps 1 in use (P6.10 and P6.11).
1	Intelligent ramps in use.
2	Acceleration and deceleration ramps 1 in use (P6.10 and P6.11). In AU-control, acceleration and deceleration ramps 2 in use (P12.3 and P12.4).
3	Intelligent ramps in use. In AU-control, acceleration and deceleration ramps 2 in use (P12.3 and P12.4).

P6.13 Field Weakening point

P6.14 Voltage at Field Weakening point

Field Weakening point is the output frequency where the output voltage reaches the set maximum value (P6.14). Above this frequency the output voltage remains at the set maximum value. See Figure 10: The U/f -curve.

For example 500 V 50 Hz motor, supply 460 V. P6.13 = 46 Hz, P6.14 = 92 % (460 V).

Note! **When the parameters P6.1 and P6.2, nominal voltage and nominal frequency of the motor, are set, parameters P6.13 and P6.14 are also set automatically to the corresponding values. If you need different values for the Field Weakening point and the maximum output voltage, change these parameters after setting parameters P6.1 and P6.2.**

P6.15 Motor control mode

0	=	Frequency control	In frequency control mode the motor frequency follows the frequency reference signal. The actual rotating speed depends on load and is equal to the slip below or above the output frequency.
1	=	Speed control:	In speed control mode the motor speed follows the speed reference signal. DynAC adjusts the motor frequency and with this function compensates the load-dependent slip.
2	=	Not used	
3	=	Speed control closed loop system	In speed control mode the motor speed follows the speed reference signal. DynAC adjusts the motor frequency and with this function compensates the load-dependent slip. In a closed loop system the motor current and speed are measured. The speed error is compensated according to the measured values.
4	=	Torque control closed loop system	In torque control mode the shaft torque is kept equal to the reference signal. In a closed loop system the motor current and speed are measured. Torque can be regulated accurately using these measurements.

P6.16 Start frequency, forward

Defines the output frequency during brake control and brake opening delays in forward direction. See Figure 7: Brake control in starting.

P6.17 Start frequency, reverse

Defines the output frequency during brake control and brake opening delays in reverse direction. See Figure 7: Brake control in starting.

P6.18 Brake control delay

Defines closing delay time of relay output RO1 (P4.2=17, external brake control). The delay starts when the DC-braking ends. See Figure 7: Brake control in starting.

P6.19 Brake opening delay

Defines the opening delay time of mechanical brake (there is always some delay in mechanical brake opening). This delay starts after brake control delay. See Figure 7: Brake control in starting.

Figure 7 shows the function of brake control and brake opening delays. During brake control and brake opening delays DynAC drives frequency defined in parameters P6.16/P6.17. The frequency defined in parameters P6.16/P6.17 is used immediately after DC-braking (no ramp). The frequency set in the ramp parameters is used after the brake opening delay. DC-braking time at start (parameter P7.9) has not effect in closed loop.

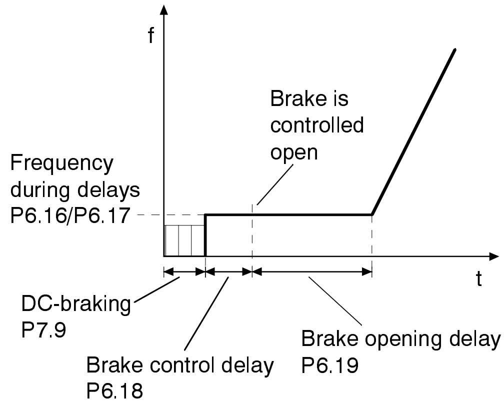


Figure 7: Brake control in starting

P6.20 Brake control frequency for stopping forward

When stopping the contact of the relay output RO1 opens when the output frequency of DynAC goes below the value set in parameter P6.20.

P6.21 Brake control frequency for stopping reverse

When stopping the contact of the relay output RO1 opens when the output frequency of DynAC goes below the value set in parameter P6.21.

P6.22 Stop function

Braking:

0 After the stop command the inverter starts braking with the mechanical brake. DC-braking is not used. DC-braking time at stop (P7.11) must be set to 0.

Ramp:

1 After the stop command the inverter starts decreasing the motor speed according to the set ramps. The brake closes as defined by parameters P6.20/P6.21.

Free wheeling:

2 After the stop command the inverter starts rolling the motor. The magnetizing is kept on until the actual speed has decreased below the brake closing speed. The brake closes as defined by parameters P6.20/P6.21. Free wheeling can be used only in closed loop.

P6.23 Switching frequency

If the switching frequency is too high, motor does not rotate smoothly; if too low, occurs high voltage spikes. Increasing the switching frequency adds device losses and reduces the continuous load capacity. If the switching frequency is too low, motor noices increase.

Switching frequency	
4.0J - 18.5J	10kHz
22J - 45J	3.6kHz
4.0F - 22F	10kHz
30F - 800F	3.6kHz
4.0K - 630K	1.5kHz

Note! **Contact factory before changing the default value of switching frequency.**

P6.24 Alternative control mode

Selections same as parameter P6.15. This alternative control mode is activated by a digital input with selection 30, see section 2.3.3. Parameter is used to change motor control mode during run in special applications.

P6.25 Correction Mode

Parameter P6.25 defines correction mode

0 Normal mode, where the drive is controlled without speed feedback from second drive.

1 Speed correction, that requires reference from external controller e.g. BY240. In DynAC the feedback is connected to analog input A_{in12} (KR Encoder board terminal 4). See parameter P3.25 selection 5. Maximum correction 10 Hz. The correction effects immediately to output frequency, normal ramp times are passed.

P6.26 A_{out1} scaling bias

Defines output signal bias value.

P6.27 A_{out1} scaling gain

Defines the scaling gain of the analog output.

$$Aout = Gain \times Signal + Bias$$

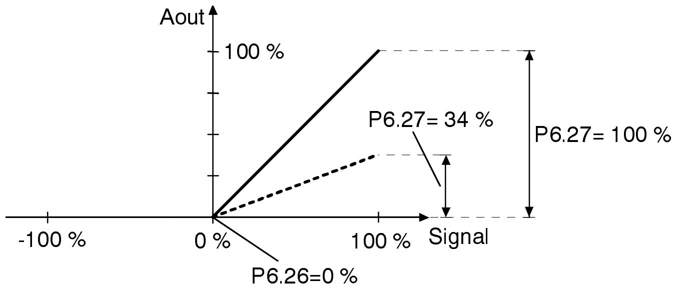


Figure 8: Scaling of analog output signal

P6.28 **A_{out11} scaling bias**
Defines A_{out11} output voltage bias level.

P6.29 **A_{out11} scaling gain**
Defines A_{out11} output signal scaling gain.

$$Aout = Gain \times Signal + Bias$$

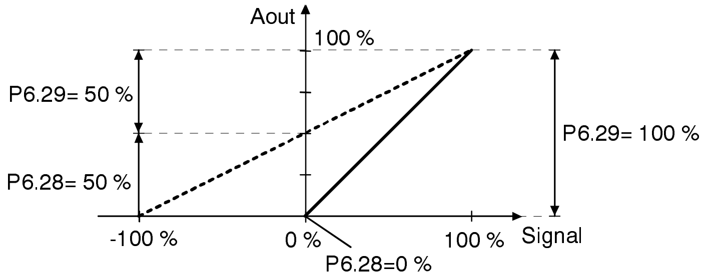


Figure 9: Scaling of analog output

Example of calculating scaling gain and zero level:
The selected signal range is 0-10V (P4.11 = 0) and the selected output signal is motor speed (P4.10 = 2). The output voltage is desired to equal 5V at zero speed and 10V at 100% speed forward. At 100% speed reverse the voltage equals 0V (P4.11 = signed) or 10V (P4.11 = unsigned).

$50\% = Gain \times 0 + Bias$
$100\% = Gain \times 1.0 + Bias$

The bias value is calculated:

$50\% = Gain \times 0 + Bias \Rightarrow Bias = 50\%$

This value is substituted into the equation:

$100\% = Gain \times 1.0 + 50\ \%$
$Gain = 50\%$
$Bias = 50\%$

2.3.7 Parameter group 7; Open loop 1

Note!	**The open loop parameters must always be set in start-up according to Appendix A9 “Open loop V/f-adjustment”.**

Note!	**The open loop parameters have no effect in closed loop.**

P7.1 Output voltage at zero frequency
This parameter defines output voltage at zero frequency, if the middle point frequency of the U/f -curve is set above zero (P7.3 > 0.0 Hz). If the middle point frequency is set zero (P7.3 = 0 Hz), defines P7.2 the output voltage at zero frequency.

P7.2 U/f-curve, mid point voltage
This parameter defines voltage in the selected middle point. See Figure 10: The U/f -curve.

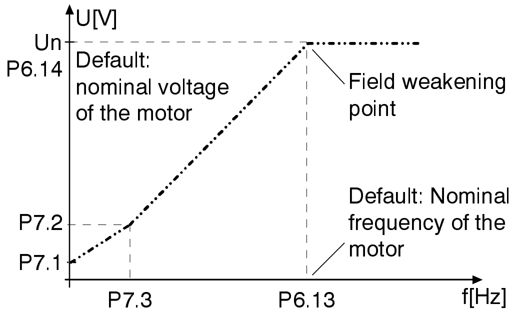


Figure 10: The U/f -curve

P7.3 U/f-curve, mid point frequency
This parameter defines the middle point frequency of the U/f -curve. See Figure 10: The U/f -curve

P7.4 Torque boost
Automatic torque maximization
The automatic torque maximization compensates the effect of the load changes to the inverter and motor operation.
0: Not used.
1: Automatic torque maximization 1. By selection 1 the torque maximization calculation uses parameter P7.8 manually set value.
2: Automatic torque maximization 2. By selection 2 the torque maximization calculation uses stator impedance value measured by DynAC. Stator impedance’s value updates also to parameter P7.8, if DC-time in start is longer than 1.0 s.

Note!	**When driving motor with the small frequency heavy torque, motor's own fan does not cool that sufficiently in the all conditions. If the motor should operate long time under the circumstances, especially notice motor's cooling. Use the outside cooling (for example additional cooling fan) if temperature of the motor aspires to rise too much.**

P7.5 IRadd motor
With small speeds and heavy load the travelling movement does not have enough voltage to produce sufficiently torque. The voltage can be increased by raising the value of parameter P7.5.
1000≅100% of calculated correction voltage is considered.

P7.6 IRadd generator
If motor voltage at generator area is too high, the voltage can be decreased by reducing value of parameter P7.6.
0≅0% of calculated correction voltage is considered.

P7.7 Cosφ -value of the motor (power factor)

Find setting value cosφ from the rating plate of the motor.
E.g. cosφ = 0.90 => P7.7 = 90

P7.8 Stator impedance

The value of the phase-to-phase stator resistance is entered in parameter P7.8. The set value must be according to a cold motor. Setting unit is Ω. The value is measured between two phases, including cable resistances (the resistance can be measured at DynAC output terminals U,V,W).

Parameter value format:

2.2-3.0	J/F/K	0.00Ω	Maximum value 320.00Ω
4.0-18.5	J/F/K	0.000Ω	Maximum value 32.000Ω
22-800	J/F/K	0.0000Ω	Maximum value 3.2000Ω

Stator impedance can be set manually or automatically according to parameter P7.4.

P7.4=0 P7.8 will be used as such inside the vector controlled motor model.
P7.4=1 P7.8 will be used as such inside the vector controlled motor model.
P7.4=2 This setting includes 3 alternative functions depending on P7.9 setting value as follows:

1) P7.9<0.20s — Function as with P7.4=1
2) 0.2s≤P7.9<1.0s — DynAC measures the stator resistance at every start. This measured value is used inside the motor model for better accuracy. The value to be used inside motor model is however limited between 0.9xP7.8 ... 1.4xP7.8 for safety.
3) P7.9≥1.0s — As alternative 2 but the measured resistance is updated to P7.8. This feature is used only to identify the resistance of a cold motor.

P7.9 DC-braking time at start

0 DC-braking is not used

>0 DC-braking is active at the start moment and this parameter defines the time before the brake is released.
After brake is released output frequency increases according to the acceleration parameters, see Figure 11: DC-braking at start and Figure 7: Brake control in starting.

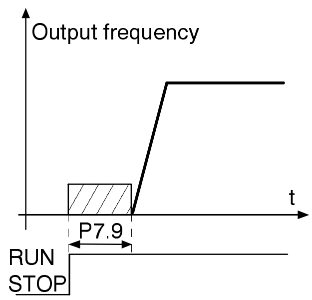


Figure 11: DC-braking at start

P7.10 DC-braking start frequency at stop

Defines the frequency at which DC-braking starts. See Figure 12: DC-braking time.

P7.11 DC-braking time at stop

Defines the function and duration of the DC-braking when stopping the motor. See Figure 12: DC-braking time.

0 DC-braking is not used

>0 Duration of the DC-braking

Parameter P6.22 (Stop-function) = 0 (brake): After the stop command the inverter starts braking with the mechanical brake. DC-braking is not used.

Parameter P6.22 (Stop-function) = 1 (ramp): After the stop command the inverter starts decreasing the motor speed according to the set ramps. DC-braking starts at the frequency defined in parameter P7.10. The braking times are defined in parameters P7.9 and P7.11. See Figure 12: DC-braking time.

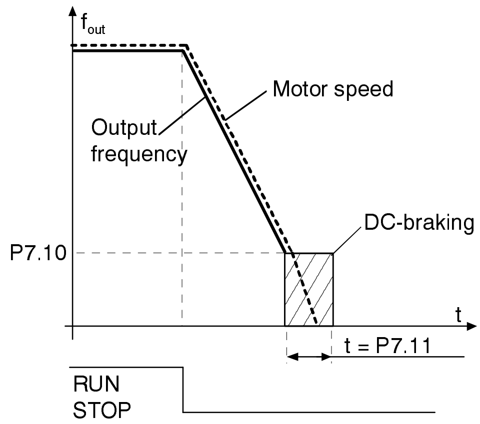


Figure 12: DC-braking time

P7.12 Torque stabilator gain

See Figure 13: Adjusting torque stabilator gain. Parameter sets the level of frequency correction to torque changes. Effects at 0-20Hz.

P7.13 Torque stabilator damp

Parameter defines how much from the previous value is noticed in calculation. E.g. 980=98%. A low parameter value causes very fast frequency correction and a high parameter value smooths the frequency correction of stabilator.

P7.14 Torque stabilator at Field weakening point

See Figure 13: Adjusting torque stabilator gain. If P7.14=0, the gain decreases to zero when frequency increases. If P7.14 > 0, the gain of stabilator changes linearly as the function of frequency. Effects at 20-120Hz.

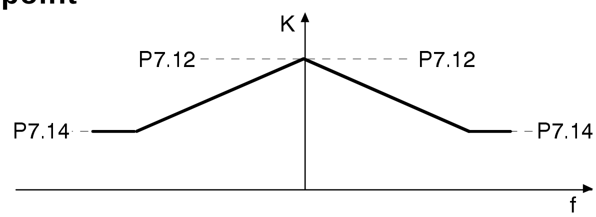


Figure 13: Adjusting torque stabilator gain

P7.15 Voltage stabilator gain

Parameter sets the level of frequency correction to fast voltage changes in DC-bus.

P7.16 Voltage stabilator damp

Parameter defines how much from the previous value is noticed in calculation. E.g. 600=60%. A low parameter value causes very fast frequency correction and a high parameter value smooths the frequency correction of stabilator.

P7.17 Field reverse frequency

Calculated parameter.

2.3.8 Parameter group 8; Closed loop 1

Note!	**The closed loop parameters must always be set in start-up according to Appendix A11 “Closed loop tuning”.**

Note!	**The closed loop parameters have no effect in open loop.**

P8.1 Encoder pulse number
Encoder pulse number is given to parameter P8.1.

P8.2 Magnetizing delay
This parameter defines how long the motor is supplied with zero frequency after the brake is closed. If the motor is started during the magnetizing delay the brake control delay is not used. The brake is controlled open immediately after start-command and during brake opening delay (P6.19) DynAC runs at the frequency set in parameter P6.16/P6.17.

P8.3 Motor nominal magnetizing current
The nominal magnetizing current of the motor. The normal setting is the value of the no-load current for the motor.

P8.4 Reserved

P8.5 Programmable slip
100 equals to 1Hz slip.

P8.6 Speed control P
The gain of the speed controller. The parameter is active all the time in closed loop speed control mode. If the gain is too large the overshoot in speed changes may occur. On the other hand if the gain is too small, the actual speed may follow the reference value poorly.

P8.7 Speed control I
The integration time of the speed controller. A small value results in fast and strong integration which compensates the speed error quickly. A large value provides smooth but possibly slow speed error response.

P8.8 Hi speed P
The gain of the high speed slip compensation controller. This controller is active only at frequencies close to the motor nominal frequency.

P8.9 Hi speed I
The integration time of the high speed slip compensation controller. This controller is active only at frequencies close to the motor nominal frequency.

P8.10 Torque control P
The gain of the torque controller. This controller is active both in the closed loop speed control and torque control modes. Too small or too large value result in oscillation in the current control.

P8.11 Torque control I
The integration time of the torque controller (see P8.10).

P8.12 Stabilator gain
The gain of the high speed stabilator.

P8.13 Start up torque
The selection of start-up torque memory and the initial value for the memory. If the value is set to 0, no start-up memory is used. However, when the parameter value is greater than 0 the memory feature is employed and the actual value is set to the memory value in the first start after power-up. After the first start the memory is automatically updated according to the actual torque.

P8.14 Slip Adjust
Motor slip fine tuning. 100.0% equals nominal slip.

P8.15 Magnetizing control P
The gain of the magnetizing controller. This controller is active both in the closed loop speed control and torque control modes. Too small or too large value result in oscillation in the current control.

P8.16 Magnetizing control I
The integration time of the magnetizing controller (see P8.15).

P8.17 Torque limitation limit
The maximum limit value for the motor torque. Normally when there is no need to limit the torque, the parameter value is set to zero. The torque limit is activated by digital input setting 31.

2.3.9 Parameter group 9; Motor parameter set 2

Description of parameter group 9 is equal to parameter group 6; Motor parameter set 1

2.3.10 Parameter group 10; Open loop 2

Description of parameter group 10 is equal to parameter group 7; Open loop 1

2.3.11 Parameter group 11; Closed loop 2

Description of parameter group 11 is equal to parameter group 8; Closed loop 1

2.3.12 Parameter group 12; Intelligent ramps

P12.1 Acceleration/ Deceleration ramp 1 shape
P12.2 Acceleration/ Deceleration ramp 2 shape

Start and end of acceleration and deceleration can be smoothed with these parameters. See Figure 14: S-shaped acceleration/deceleration. The smoothing is done by parameter P12.1 for ramp 1 and by P12.2 for ramp 2. Setting value zero gives a linear ramp shape which causes acceleration and deceleration to act immediately to the changes in the reference signal. Increasing the value in the range of 0.1-10s smooth's the shape of the ramp. In EP-control mode there is no S-shape at the end of the ramp.

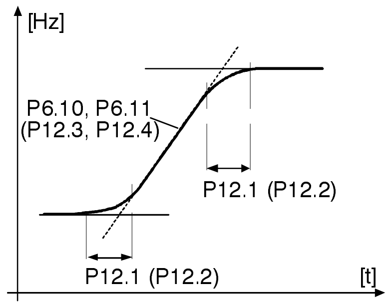


Figure 14: S-shaped acceleration/deceleration

P12.3 Acceleration time 2
P12.4 Deceleration time 2

These values correspond to the time required for the output frequency to accelerate from zero to the set nominal frequency (P6.2). These parameters allow a choice at two different acceleration/deceleration time sets for one application. The set can be activated by a digital input programmed for this selection (see digital input selections in section 2.3.3, selection 4 = acceleration / deceleration time 2 selected). Shorter acceleration / deceleration time than the factory setting of P6.10/P6.11 must not be used. If alternatives 2 or 3 are selected in parameter P6.12, these ramps are used in AU-mode.

Intelligent ramps P12.5-P12.26

P12.5 Frequency f1
P12.6 Frequency f2

If the intelligent ramps have been selected with parameter P6.12, these parameters define frequencies f1 and f2. See figures 15-18.

P12.7 Acceleration time 1 forward
P12.8 Acceleration time 2 forward
P12.9 Acceleration time 3 forward
P12.10 Acceleration time 3 forward with Field Weakening

If the intelligent ramps have been selected with parameter P6.12, these parameters define acceleration times in forward direction. Acceleration time is the time needed to accelerate from zero to the nominal frequency of the motor. See Figure 15: Acceleration ramps forward.

Example.	Acceleration time 2 fwd	P12.8 = 2.5 s.
	Frequency f1 fwd	P12.5 = 10 Hz.
	Frequency f2 fwd	P12.6 = 20 Hz.
	Nominal frequency f_n	P6.2 = 50 Hz

Then, acceleration from f_1 to f_2 takes

$$t_{f1 \to f2} = \frac{(f_2 - f_1)}{f_n} * t_2 = \frac{(20\ Hz\ - 10\ Hz)}{50\ Hz} \cdot 2{,}5s = 0{,}5\ s$$

P12.11 Deceleration time 1 forward
P12.12 Deceleration time 2 forward
P12.13 Deceleration time 3 forward
P12.14 Deceleration time 1 forward with Field Weakening

If the intelligent ramps have been selected with parameter P6.12, these parameters define deceleration times in forward direction. Deceleration time is the time needed to decelerate from the nominal frequency of the motor to zero. See Figure 16: Deceleration ramps forward.

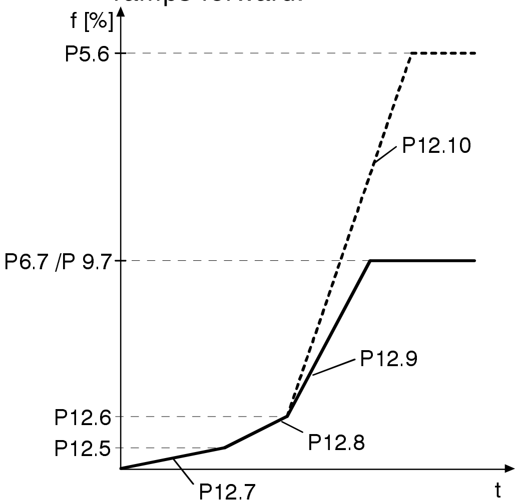


Figure 15: Acceleration ramps forward

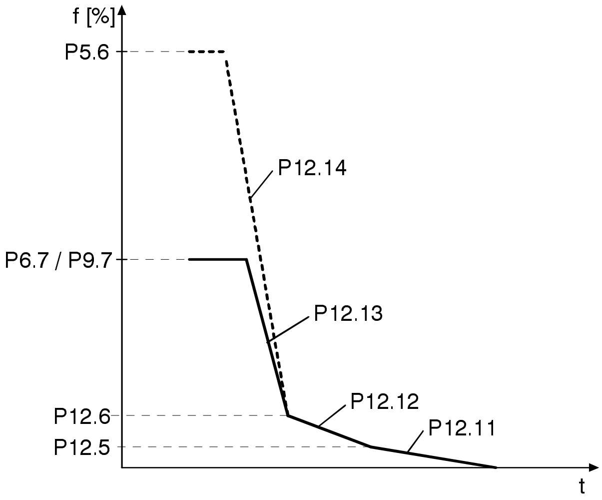


Figure 16: Deceleration ramps forward

P12.15 Deceleration time forward, direction change

If the intelligent ramps have been selected with parameter P6.12, this parameter defines the deceleration time forward when change of running direction is requested. Deceleration time is the time needed to decelerate from the nominal frequency of the motor to zero.

P12.16 Deceleration time forward, stop

If the intelligent ramps have been selected with parameter P6.12, this parameter defines the deceleration time forward if run command is not ON. Deceleration time is the time needed to decelerate from the nominal frequency of the motor to zero. The stopping function works in AU- and PO-control modes. In EP-control mode, this parameter has no effect.

P12.17 Acceleration time 1 reverse
P12.18 Acceleration time 2 reverse
P12.19 Acceleration time 3 reverse
P12.20 Acceleration time 3 reverse at Field Weakening

If the intelligent ramps have been selected with parameter P6.12, these parameters define acceleration times in the reverse direction. Acceleration time is the time needed to accelerate from zero to the nominal frequency of the motor. See Figure 17: Acceleration ramps reverse.

P12.21 Deceleration time 1 reverse
P12.22 Deceleration time 2 reverse
P12.23 Deceleration time 3 reverse
P12.24 Deceleration time 3 reverse at Field Weakening

If the intelligent ramps have been selected with parameter P6.12, these parameters define deceleration times in forward direction. Deceleration time is the time needed to decelerate from the nominal frequency of the motor to zero. See Figure 18: Deceleration ramps reverse.

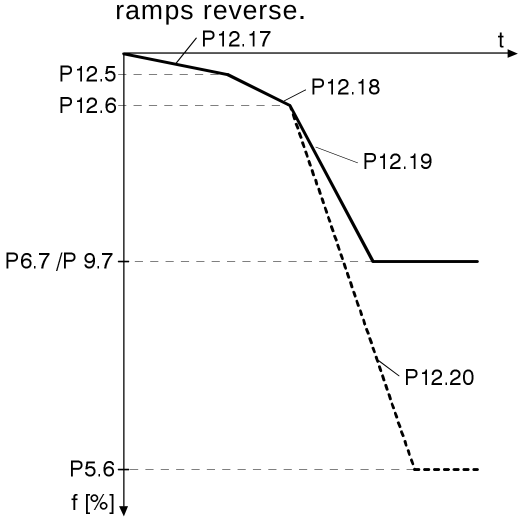


Figure 17: Acceleration ramps reverse

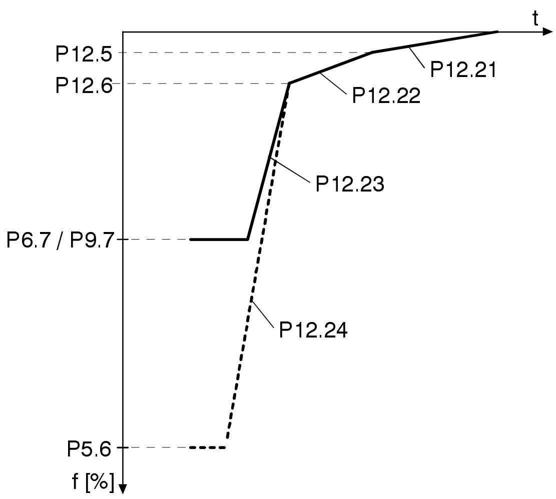


Figure 18: Deceleration ramps reverse

P12.25 Deceleration time reverse, direction change

If the intelligent ramps have been selected with parameter P6.12, this parameter defines deceleration times when change of running direction is requested. Deceleration time is the time needed to decelerate from the nominal frequency of the motor to zero.

P12.26 Deceleration time reverse stop

If the intelligent ramps have been selected with parameter P6.12, this parameter defines deceleration times in forward and reverse direction if run command is not ON. Deceleration time is the time needed to decelerate from the nominal frequency of the motor to zero. The stopping function works in AU- and PO-control modes. In EP-control mode, this parameter has no effect.

Example with intelligent ramps:

v = 150m/min =2.5 m/s
t1 = running time of ramp set in parameter P12.11
t2 = running time of ramp set in parameter P12.12
t3 = running time of ramp set in parameter P12.13

$$t1 = t_{f1 \to f0} = \frac{P12.5}{P6.2} \times P12.11 = \frac{12{,}5\ Hz}{50\ Hz} \times 12s = 3{,}0\ s$$

$$t2 = t_{f2 \to f1} = \frac{(P12.6 - P12.5)}{P6.2} \times P12.12 = \frac{(25\ Hz - 12{,}5\ Hz)}{50\ Hz} \times 8s = 2{,}0\ s$$

$$t3 = t_{f3 \to f2} = \frac{(P6.2 - P12.6)}{P6.2} \times P12.13 = \frac{(50\ Hz - 25\ Hz)}{50\ Hz} \times 6s = 3{,}0\ s$$

t = t1 + t2 + t3 = 3,0s + 2,0s + 3,0s = 8,0s

$$s1 = \frac{P6.2 + P12.6}{2 \times P6.2} \times t3 \times v = \frac{50\ Hz + 25\ Hz}{2 \times 50\ Hz} \times 3{,}0\ s \times 2{,}5\ m/s = 5{,}6\ m$$

$$s2 = \frac{P12.5 + P12.6}{2 \times P6.2} \times t2 \times v = \frac{12{,}5\ Hz + 25\ Hz}{2 \times 50\ Hz} \times 2{,}0\ s \times 2{,}5\ m/s = 1{,}9\ m$$

$$s3 = \frac{P12.5}{2 \times P6.2} \times t1 \times v = \frac{12{,}5\ Hz}{2 \times 50\ Hz} \times 3{,}0\ s \times 2{,}5\ m/s = 0{,}9\ m$$

s = s1 + s2 + s3 = 5,6m + 1,9m + 0,9m = 8,4m

Intelligent ramps

P6.2	P12.5	P12.6	P12.11 (t1)	P12.12 (t2)	P12.13 (t3)	t	s1	s2	s3	s
50 Hz	12.5 Hz	25 Hz	12s (3s)	8s (2s)	6s (3s)	8s	5.6 m	1.9 m	0.9 m	8.4 m

Normal ramps

P6.2	P6.11	s
50 Hz	8 s	10 m
50 Hz	6.75 s	8.4 m

With intelligent ramps you can get a shorter deceleration distance than with normal ramps if you are using same deceleration time. At the same time it is possible to have an excellent touch in load positioning due to slow ramp at low speed. If same the deceleration distance is desired with normal ramps the time must be shorter (in example deceleration time with intelligent ramps is 8s and same deceleration distance is desired with normal ramps the time must be 6.75 s).

If plugging braking kind of operation is desired it can be done with parameters P12.15 and P12.25 (Deceleration time in direction change).

2.3.13 Parameter group 13; Profibus diagnostic parameters

Note! **The setting of these parameters must comply with the settings and software of the Profibus master PLC. For more detailed description and additional information see Profibus documentation.**

P13.1 Slave address

Specifies the station address for the DynAC when used as a slave in the Profibus controlled by the PLC master. Each slave must have a unique station address. The range of the address selection is 2-126. The address change takes effect after power off and restart.

P13.2 Baud rate

The transmission speed of the Profibus system is set with the baud rate parameter. The rate change takes effect after power off and restart. The baud rate of the DynAC slave must be equal to the baud rate of the master. The baud rate is given with a number:

1	=	9.6 kbaud	5	=	500 kbaud	9	=	12 Mbaud
2	=	19.2 kbaud	6	=	1.5 Mbaud	10	=	AUTO
3	=	93.75 kbaud	7	=	3 Mbaud			
4	=	187.5 kbaud	8	=	6 Mbaud			

The auto baud rate selection automatically adapts the DynAC slave to the transmission speed of the master.

P13.3 PPO-type

Sets the PPO (Parameter - Process Data Object) type used in communication between the DynAC slave and the master. Four types of data objects 1, 2, 3 and 4 are possible. The type change takes effect after power off and restart.

P13.4 Actual value

The content of the data word called Actual value is specified with this parameter. This data word is included in every PPO type. The possible selections are

1	=	Output frequency	6	=	Motor voltage	10	=	Frequency reference
3	=	Motor current	7	=	DC-link voltage	11	=	IO word

P13.5 Process data 1

This parameter specifies the content of the data word called Process data 1 transferred with the PPO types 2 and 4. There are 14 possibilities the detailed description of which is given in Profibus documentation.

1	=	Output frequency	6	=	Motor voltage	11	=	IO word
2	=	Motor speed	7	=	DC-link voltage	12	=	D/A board ch1
3	=	Motor current	8	=	Ain1 status	13	=	D/A board ch2
4	=	Motor torque	9	=	Ain2 status	14	=	D/A board ch3
5	=	Motor power	10	=	Frequency reference			

P13.6 Process data 2

This parameter specifies the content of the data word called Process data 2 transferred with the PPO types 2 and 4. There are 14 possibilities the detailed description of which is given in Profibus documentation. Selections are same as in parameter P13.5.

P13.7 Process data 3

This parameter specifies the content of the data word called Process data 3 transferred with the PPO types 2 and 4. The possibilities are listed in section 2.1.3 “Monitoring page”. The detailed description of the data word is given in Profibus documentation.

P13.8 Process data 4

This parameter specifies the content of the data word called Process data 4 transferred with the PPO types 2 and 4. The possibilities are listed in section 2.1.3 “Monitoring page”. The detailed description of the data word is given in Profibus documentation.

2.3.14 Parameter group 14; Profibus control

Note!	**The changes in this parameter group are not activated until after the next power-on situation. Therefore to activate the changes of these parameters it is necessary to switch off the power to the inverter, wait until the DC-voltage has lowered (LEDs in the display are off), and switch on the power to the inverter.**

P14.1 Bus control

The parameter selection for the Profibus control.

0 = No — The inverter does not read the reference values or any digital inputs from Profibus. Instead all analog and digital inputs from the inverter terminals are read and the operations according to the parameters in the group 3 are active.

1 = Yes — The inverter reads analog reference values from Profibus only. The digital inputs are read from the terminals or from Profibus depending on the parameters 14.2 …14.10.

The control via Profibus requires that

A) the inverter is equipped with the Profibus expansion board

B) the parameter P14.1 = 1 and

C) the digital input DIC11 (A2:9) i.e. CMS (X1:18) must be active

When these three requirements are satisfied the speed reference, the torque reference and the correction signal are only read via Profibus. However, the digital inputs can be read from the terminal or Profibus or both. The parameters P14.2 … 14.10 specify for each input separately where they are read from.

P14.2 DIA1 source

Operation: S1 direction request

Possible selections:

0 = Terminal — The inverter reads only the corresponding terminal input. Profibus has no effect on this operation.

1 = Bus — The inverter reads only the Profibus bit associated with this input. The corresponding hardwired terminal input has no effect on this operation.

2 = AND — The operation is active when the corresponding terminal input AND the Profibus bit are active.

3 = OR — The operation is active when the corresponding terminal input OR the Profibus bit is active.

P14.3 DIA2 source

Operation: S2 direction request

P14.4 DIA3 source

Operation: specified with the parameter P3.1

P14.5 DIB4 source

Operation: specified with the parameter P3.2

P14.6 DIB5 source

Operation: specified with the parameter P3.3

P14.7 DIB6 source

Operation: specified with the parameter P3.4

P14.8 DIC12 source

Operation: specified with the parameter P3.16

P14.9 DIC13 source

Operation: specified with the parameter P3.17

P14.10 DIC14 source

Operation: specified with the parameter P3.18

P14.11 Bus fault delay

If the inverter detects a Profibus communication error it is possible to delay the triggering of the fault. If any delay is given to the parameter and a Profibus communication error occurs when the inverter is running, this immediately initiates the normal stop procedure according to the effective deceleration ramp (typically P6.11). When the delay time has expired, the fault situation is triggered independently of the running situation and the fault F27 is indicated. The possible range of the delay parameter is 0.0s … 5.0s.

2.3.15 Parameter group 15; Protection parameters

In the text below, the following terms are used

Brake stop	= Brake contactor K7 will be de-energized.
Fault stop	= Brake contactor K7 and line contactor K1 will be de-energized.

P15.1 Motor thermistor (Warning A29/Fault 29)

Default value 0. Encoder/Expander board terminals 21 (T1) and 22 (T2)

Thermal protection of the motor windings can be made by using thermistors. They ensure that the temperature of the windings does not increase excessively, for example, due to decreased cooling.

0	=	Error	Brake stop F29. A fault does not open the fault contact but the brake contact is opened.
1	=	Warning	Warning A29. Brake stop after power down (value returns to 0).
2	=	Fault	Fault stop F29. The fault contact (RO2 K1/K01 control) is opened after the fault. Motor is stopped with the mechanical brake.

P15.2 Response to A_{in} reference fault (Warning A46/Fault F36)

Default value 2.

Defines action taken when analog input reference value is smaller than the minimum value. A warning or a fault message is generated if a signal range of 2-10V or 1-9V is being used and the signal is out of range. If relay output RO13 (P4.9) is available the indication of reference fault can be programmed to it.

0	=	No	No action
1	=	Disable	Disable input. Input signal is read as zero when signal is out of range.
2	=	Warning	Warning A46. Input signal is read as zero when signal is out of range.
3	=	Fault	Brake stop F36. The fault contact (RO2 K1/K01 control) is opened after the fault. Motor is stopped with the mechanical brake.

P15.3 Brake chopper

0	=	No
1	=	Yes, internal
2	=	Yes, external

P15.4 Line supervision (Fault F10)

0	=	No	No action
2	=	Fault	Fault stop F10. The fault contact (RO2 K1/K01 control) is opened after the fault. Motor is stopped with the mechanical brake.

P15.5 Phase supervision of the motor (Fault F11)

Default value 2.

Phase supervision of the motor continuously checks that the motor phases have about equal current. With this parameter this function can be turned off.

0	=	No action	No action
2	=	Fault	Fault stop F11. The fault contact (RO2 K1/K01 control) is opened after the fault. Motor is stopped with the mechanical brake.

P15.6 Earth fault protection (Fault F3)

Default value 2.

Earth fault protection continuously checks that the sum of the motor phase currents is zero. With this parameter this function can be turned off. The overcurrent protection is always active and protects the inverter from low impedance earth faults.

0	=	No	No action
2	=	Fault	Fault stop F3. The fault contact (RO2 K1/K01 control) is opened after the fault. Motor is stopped with the mechanical brake.

P15.7 Prohibit frequency area 1 low limit
P15.8 Prohibit frequency area 1 high limit
P15.9 Prohibit frequency area 2 low limit
P15.10 Prohibit frequency area 2 high limit

In some applications certain output frequencies may cause mechanical resonance. It is possible to set two prohibited frequency areas within 0-f_{max} with parameters P15.7-P15.10. The prohibited frequency areas are crossed over according to the set accelerating and decelerating times. The prohibited frequency area is inactive if the set value is 0.0 Hz.

Note!	**When the prohibited frequency areas are being set the high limit must be set before the low limit. The high limit must be greater than the low limit.**

P15.11 Motor overcurrent multiplier P

Overcurrent control P-multiplier on motor side. Overcurrent control is not used in closed loop (P6.15=3 or P6.15=4), or motor rotating as generator.

P15.12 Motor overcurrent multiplier I

Overcurrent control I-multiplier on motor side. Overcurrent control is not used in closed loop (P6.15=3 or P6.15=4), or motor rotating as generator.

2.3.16 Parameter group 0; Application parameters

P0.1 Load application

Crane application is selected in parameter P0.1. It is possible to set the factory default values by parameter P0.1. This selection will also initialize the crane application.

P0.2 Load parameters

With this parameter it is possible to accomplish transfer commands. Parameter value changes to zero automatically after transfer (transfer ready).

0 Transfer ready/Select loading
Transfer operation done, inverter ready.

1 Load defaults
Factory default parameters can be restored by changing parameter P0.2 value to 1. Press Enter-key after selection. The selected application (P0.1) determines the default values. The factory default values prevent DynAC operation.

2 Store parameter settings as user's default
User's default parameters can be saved by parameter P0.2 selection 2. Press Enter-key after selection. User's default values can be restored by P0.2 selection 3.

3 Restore user's default parameter settings
User's default values can be restored by parameter P0.2 selection 3. Press Enter-key after selection.

4 Upload to panel (NOTE! graphic panel required).
With this selection (Upload), the inverter parameters will be stored in the panel's memory. Press the Enter-key after selection. Parameters can be restored using parameter P0.2 selection 5.
The up to panel command is very useful when you have several inverters which have the same parameters. With Up to panel and Down from panel selections you can easily copy parameters from one inverter to another.

5 Download from panel (NOTE! graphic panel required).
With this selection (Download) parameters can be restored from the panel memory. Parameters will be restored using parameter P0.2 selection 5. Press Enter-key after selection.

3 START-UP PROCEDURE

If any problems or malfunctions occur during the start-up, refer to Chapter 5 “Troubleshooting”, to find out the reason. All problems must be solved before continuing. For further information contact

KONECRANES COMPONENTS CORPORATION
Electrics and Automation Center CHE3
P.O.Box 662 FIN-05801 Hyvinkää
FINLAND
Phone +358-(0)20-42711

Warning!	**High voltages inside DynAC. Wait for at least five minutes after the supply voltage has been switched off before service actions. Display in operating condition (lights on) indicates a dangerous voltage on the DC-bus. When display turns off, the DC-bus voltage is about 100V. Note also that there is a dangerous voltage in the braking resistor always when the DC-bus is charged.**

Do not connect any voltage to the output terminals of DynAC (U, V, W). Otherwise, the inverter will be damaged.

Note!	**Connect power (L1, L2, L3) to the terminals of K1, and motor on the inverter to U, V, W.**

The overload protection of DynAC protects both the supply and the motor cables. The fuses of the supply provide short circuit protection.

Note!	**The open loop parameters must always be set in start-up according to Appendix A9 “Open loop V/f-adjustment”.**

Note!	**The closed loop parameters must always be set in start-up according to Appendix A11 “Closed loop tuning”.**

3.1 Visual checks

- Record all checks and results in the commissioning table.
- Check condition of cubicles.
- Check that the DynAC serial number is the same as in all delivery documents (testing table, parameter list, commissioning table etc.).
- Check the supply voltage selection of transformer T1, T2 and T11. The alternatives are
  - F-series: 380/400V, 415V, 440/460V, 480/500V
  - J-series: 200V, 230V
  - K-series: 525V, 575/600V, 660/690V
- Check the fuse values of the 48V and 230V secondary coils in T1, T2 and T11 (see the DynAC spare parts list for fuse values). Please note that fuse holders are not keyed.
- Check the control voltage selection of DynABoard KAE250 (X36 terminals A, B or C). See Appendix A3 "DynABoard".
- Remove inverter cover and check the voltage selection of the transformer(s) inside inverter.
- Check the cabling from motor and brake to DynAC.
- Check motor type.
- Check the wire terminations in the motor connection box (connection for motor, thermistors, heaters, brake wear and encoder circuits).
- Check encoder connections.
- Disconnect the motor (U, V, W) and brake coil cable from DynAC, so that the DynAC will not be damaged. Measure isolation resistance of motor windings (each phase to ground) and brake coil.
- Check brake resistor(s).
- Terminals X1:31-40 and X1:71-80 are for electronics level signals. Check that no control or line voltage level wires are connected there. Normally only shielded wires (or jumper wires) are connected to these terminals.
- Re-connect motor and brake cables to DynAC.
- Re-install the inverter cover.

3.2 Checks before the first test run

Warning! High voltages inside DynAC.

- Check power supply voltage (nominal voltage +/- 10%).
- Make sure that run commands are off (pushbuttons / controller (master switch) at zero position).
- Turn on power from main switch and control voltage switch.
- Check that run command LEDs (S1 and S2 at DynABoard) are also off.
- Within about 1 second the control panel should display "AC on", and then in about 1 second the display changes to motor output frequency "0.00" and Ready lamp turns on. In a fault situation the display will show a blinking fault code "F xx" instead of frequency.
- Set supply voltage parameter P2.3 according to line voltage. See P2.3 description for details.

  In models 7.5F-45F only
  - Turn off power and wait, until the lamps of display are off.
  - Turn on power again, the display of control panel must operate as above.
- Check that the Ready lamp on DynABoard is lit.
- Check that external connections and programming of digital inputs are according to application.
- Parameters are properly set after factory tests and no adjustments are needed except for the parameters that depend on application and motor. Write down to the parameter list all the values that have been changed.

3.3 Test run without load

- See also Appendix A9 “Open loop V/f-adjustment” and Appendix A11 “Closed loop tuning”.
- Make sure that movement will not cause any danger to the environment or to the crane itself. Avoid driving close to the limit areas.
- Check limit switches manually if possible and check the proper LEDs on DynABoard.
- Check run commands on DynABoard and correct motor rotating direction. S1 is lit when forward direction is applied and S2 is lit when reverse direction is applied.
- Check the function of the encoder
  - See "Troubleshooting of encoder connections" (in appendix)
- Drive forward at minimum speed for 5 to 10 seconds. Accelerate to full speed. Run 5 to 10 seconds. Stop. Repeat the same in reverse direction. Check the frequency display to make sure that the frequency changes through the whole operational frequency range from minimum to nominal speed.
- Check motor operation (acceleration, deceleration and braking): accelerate to full speed forward, change to full speed reverse and full speed forward again and stop.
- Check limit switch functions: drive forward slowly and check the slowdown and stop limit switch operations. Re-check using full speed. Repeat the same check for reverse direction.
- If the optional ESR is used, check the maximum frequency as stated in testing table.

3.4 Test run with load

- See also Appendix A11 “Closed loop tuning”.
- Note, three loads are required:
  - Nominal load (100%) for normal operation.
  - Limited load for ESR (optional).
  - An adequate extra load for dynamic overload testing and to test the ESR load limit.
- See maintenance instruction HU1.03.0004 “Erection, Installation and Testing of EOT cranes” for details of the load tests.
- Make sure that movement will not cause any danger to the environment or to the crane itself.
- If the optional extended speed range (ESR) is used, check that the load limit is correctly set and travelling with bigger loads is prevented.
- Drive in both directions at minimum and maximum speeds.

3.5 After the test run

- Record all parameter value changes in the parameter list.
- Set the parameter P2.2 value to 0 to disable parameter changes.
- Make sure all remarks and setting values are recorded in commissioning table.

4 SERVICE

DynAC does not require regular maintenance. The following actions are recommended:

1. Check inverter fault history
   - Find out reasons of possible faults
   - Clear the fault history
2. Clean the heat sink of the inverter
   - Prevent the dust to spread inside cubicles
   - Lock the fans before blowing compressed air
3. Check that there are no abnormal noises coming from the cooling fans
4. Tighten all screws and connectors
5. Clean dust from PC-boards

Note!	**The parameters are saved in an EEPROM, which keeps the parameters in memory after power off without any battery backup.**

5 TROUBLESHOOTING

Warning!	**High voltages inside DynAC. Wait for at least five minutes after the supply voltage has been switched off before service actions. Display in operating condition (lights on) indicates a dangerous voltage on the DC-bus. When display turns off, the DC-bus voltage is about 100V. Note that there is a dangerous voltage in the braking resistor always when the DC-bus is charged.**

This chapter describes how to detect DynAC failures. The purpose is to find out which components are damaged and how to replace them to restore proper operation. Advice is also given to find possible external failures that affect DynAC function.

For further information contact

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5.1 Inverter fault codes

If any of the following failures is found, the inverter displays the fault code and closes the mechanical brake causing the movement to stop. If several faults occur one after another, the latest one is displayed, the others are stored to fault history page. DynAC includes an automatic fault reset operation; the fault code stays on the display until the fault is removed and the controller released back to 0-position. Some of the fault codes require to switch the power off before run is possible.

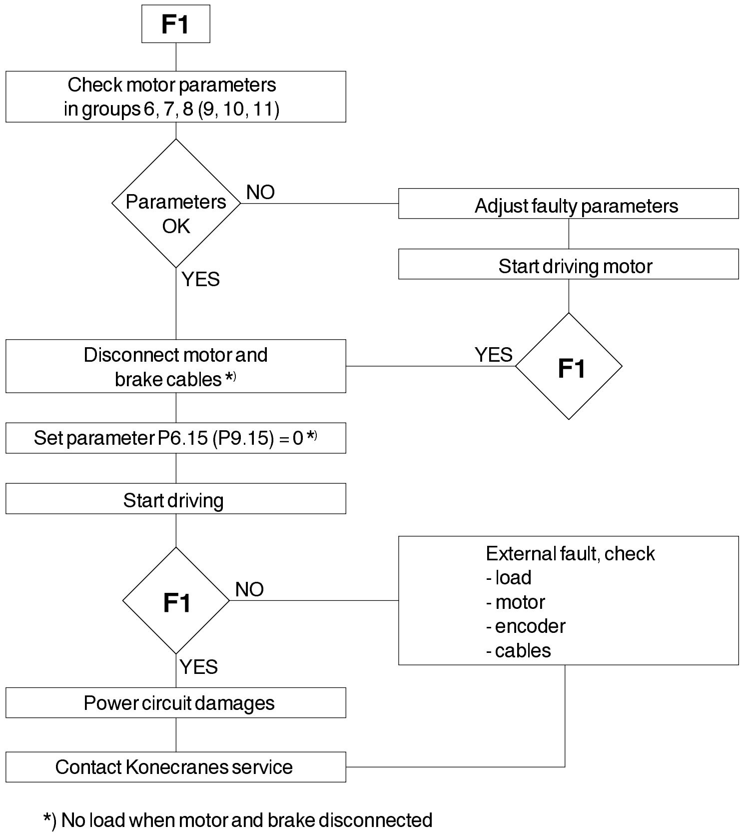
When inverter fault supervision trips, the FAULT indicator turns on and the blinking fault code "F xx" (xx = fault number) appears on the display. The faults are stored to the fault history, from there they can be seen if necessary.

Fault code	Fault	Possible cause	Checking
F 1	Overcurrent	Inverter has measured too high current (over 4*In) in the motor output: – sudden heavy load increase – short circuit in the motor cables – not suitable motor – wrong motor parameters	Reset: switch power off and restart after the lamps of display are off. – Check motor loading – Check motor type – Check motor power rating – Check cables – Check parameters – Check brake operation
F 2	Overvoltage	DC-bus voltage has exceeded 135% maximum level, 437 Vdc (J-), 911Vdc (F-), 1258 Vdc (K-series) – supply voltage raised >1.35 x Un (high overvoltage spikes at mains) – deceleration time is too short	Adjust the deceleration time longer
F 3	Earth fault	Current measurement has sensed unbalance in motor phase currents (supervision level is 5%) – insulation failure in the motor or the cables	Reset: switch power off and restart after the lamps of display are off. – Check motor cable and motor
F 4	Inverter fault	Inverter has detected faulty operation in the gate drivers or IGBT bridge – interference fault – component failure	Reset: switch power off and restart after the lamps of display are off. – If the fault comes again, contact Konecranes service.
F 5	Charging switch	Charging switch is open when START command becomes active – interference fault – component failure	Reset: switch power off and restart after the lamps of display are off. – If the fault comes again, contact Konecranes service.
F 9	Undervoltage	DC-bus voltage has dropped below 65% of rectified supply voltage – mains supply voltage <0.65 x Un – inverter fault can also cause an undervoltage trip	In case of temporary supply voltage break, reset the fault and start again. Check mains input. – If mains supply is correct, an internal failure has occurred. – Contact Konecranes service.
F 10	Input line supervision	One input line phase is missing or supply voltage parameter is wrong	Check supply voltage and the mains connection.
F 11	Output phase supervision	Current supervision has sensed that one of the motor phases has no current	Check motor cables

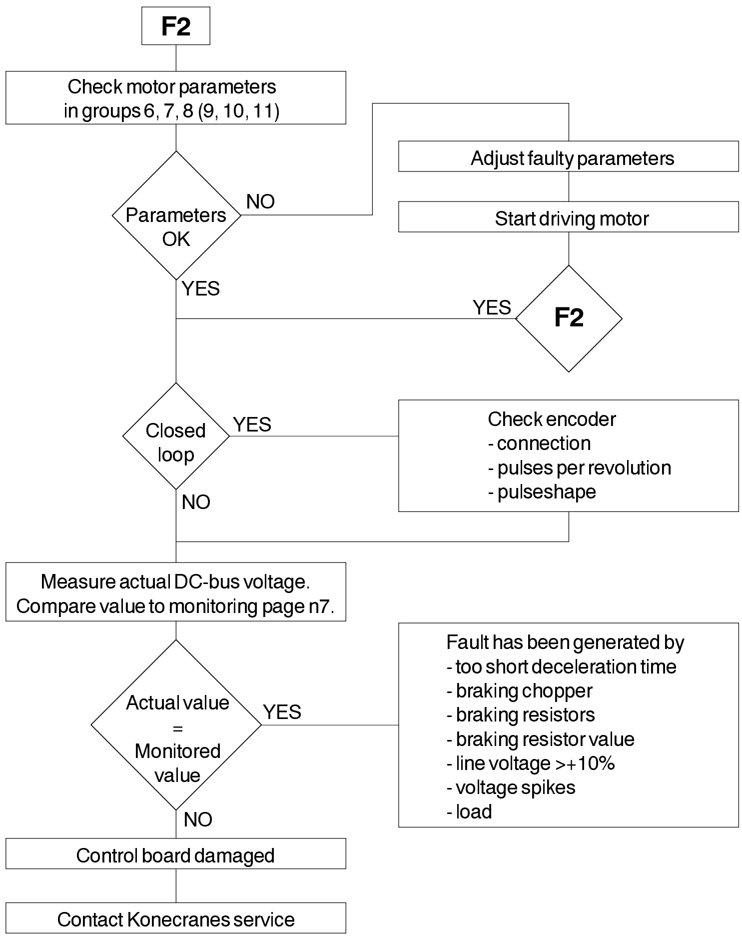
Fault code	Fault	Possible cause	Checking
F 12	Braking chopper supervision	– braking resistor broken – braking chopper broken – braking resistor not installed	Reset: switch power off and restart after the lamps of display are off. Check braking resistor – If resistor is OK, then the chopper is broken – Contact Konecranes service
F 13	Inverter undertemperature	Temperature of heat sink below -10°C (14°F)	Check ambient temperature
F 14	Inverter overtemperature	Temperature of heat sink over +75°C (167°F)	– Check the cooling air flow – Check that heat sink is not dusty – Check ambient temperature
F 18	Analog input hardware fault	Component failure on control board – high voltage in analog input	Check connections and change control board. – Contact Konecranes service.
F 19	Option board identification	Installed option board does not have correct identification	Check the installation of expansion board. – Check profibus cable connection – If installation is correct, contact Konecranes service
F 20	10V reference	+10V reference shorted/overloaded or faulty control board	Check the cabling from +10V reference voltage.
F 21	24V supply	+24V supply shorted/overloaded or faulty control board	Check the cabling from +24V reference voltage output.
F 22 F 23 F 24	EEPROM checksum fault	Parameter restoring error – interference fault – component failure (control board) – faulty supply voltage programming	After power off the inverter will automatically load factory default parameter settings. Drive does not work properly nor enable driving after this fault. Check all parameter settings. – If the fault comes again, contact Konecranes service.
F 25	Microprocessor watchdog-fault	– interference fault – component failure (control board)	Reset: switch power off and restart after the lamps of display are off. – If the fault comes again, contact Konecranes service.
F 26	Panel communication error	Poor connection between inverter and display panel	Check the panel connection and optional cable.
F 27	Profibus communication error	Poor Profibus cable connection or communication problems with Profibus master – watchdog time out	Reset: switch power off and restart after the lamps of display are off. If the fault comes again, contact Konecranes service.
F 29	Thermistor fault	Expansion board thermistor input has detected motor overtemperature	– Check motor cooling and loading – Check thermistor connection (if expansion board thermistor input is not used, it should be shorted) – Check parameters – Check the brake opens

Fault code	Fault	Possible cause	Checking
F 31	Encoder no pulse	Encoder pulses not received, one or both channels missing	Check encoder wiring and encoder. Check the brake opens.
F 32	Encoder direction fault	Encoder signal channels A+ and B+ in wrong order	Cross-connect signal wires in terminals EA+ and EB+.
F 33	I^2t and current cutter supervision	Long duration overload or at current cutter – sudden heavy load increase – not suitable motor – wrong motor parameters	Reset: switch power off and restart after the lamps of display are off. – Check encoder pulse number – Check encoder connection – Check motor parameters – Check stator impedance – Check motor loading – Check motor type – Check motor power rating – Check brake operation
F 34	Generator side current limit	Too short deceleration time or closed loop generator side current limit	– Check deceleration time – Check current limit – Check closed loop speed controller
F 36	Reference value fault	Analog input signal is out of selected range 1-9V or 2-10V or 4-20mA – control cable is broken – signal source has failed	Check cabling and reference source.
F 51	Stop limit	Stop limit has tripped	Ensure that fault disappears after leaving the stop limit.
F 52	External stop	The line contactor has been tripped during run	– Check ES and RDY external connections – Check brake operation – Check encoder function and cabling
F 53	No brake	The setting of relay output RO1 (control of K7) = 0 – Faulty parameter setting – EEPROM checksum fault	Check all parameter values – Fault prevents driving – If the fault comes again, contact Konecranes service.
F 54	Profibus control fault	Profibus control changes status (DIC11, CMS input) when the inverter is in running state. – check the CMS-input control	Reset: switch power off and restart after the lamps of display are off. If the fault comes again, contact Konecranes service.

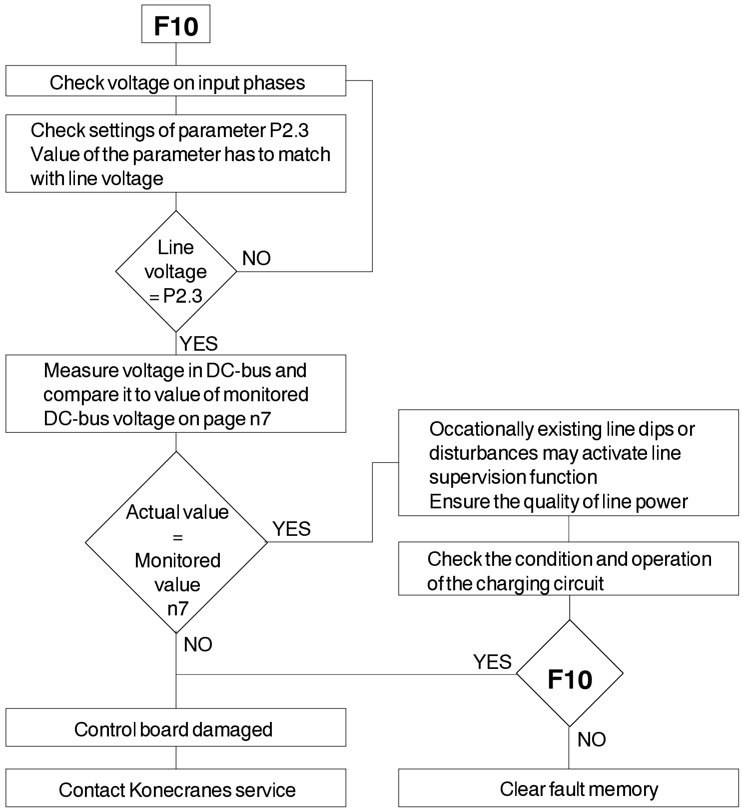
F1 Overcurrent



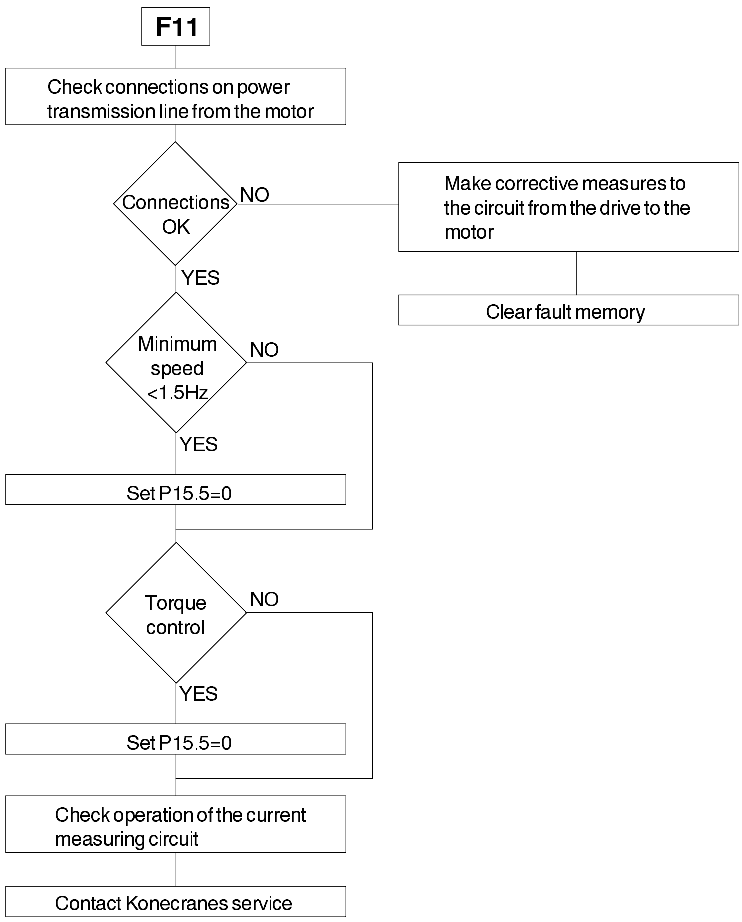
F2 Overvoltage



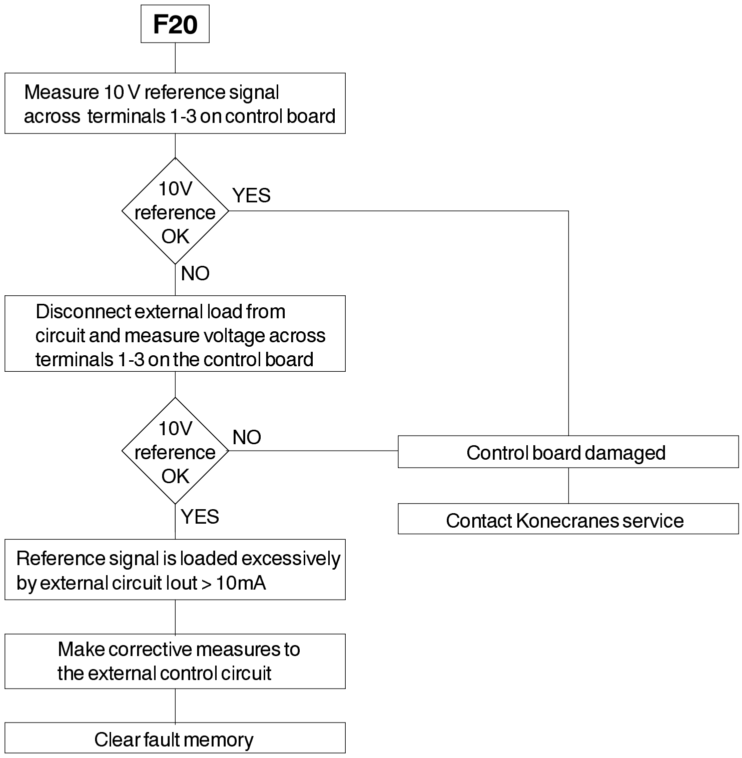
F10 Input line supervision



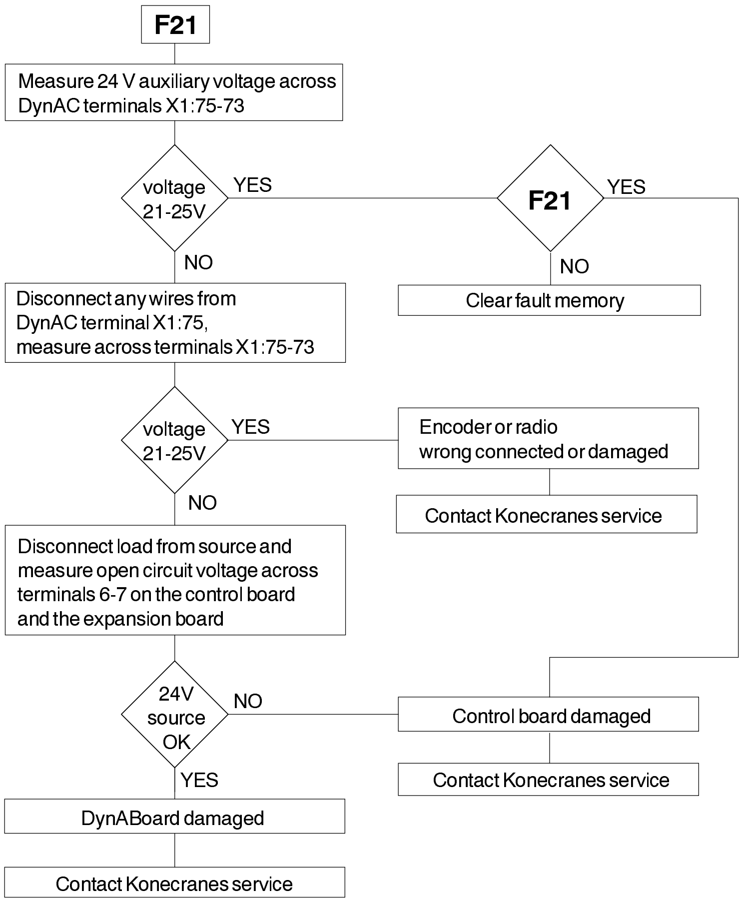
F11 Output phase supervision



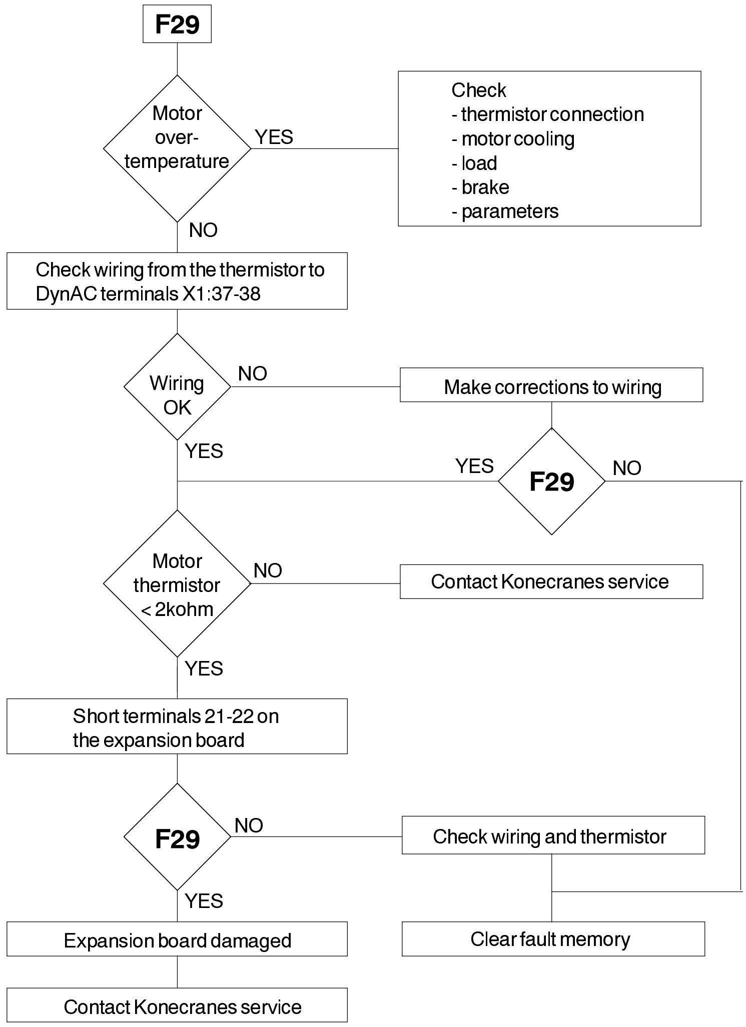
F20 10V reference



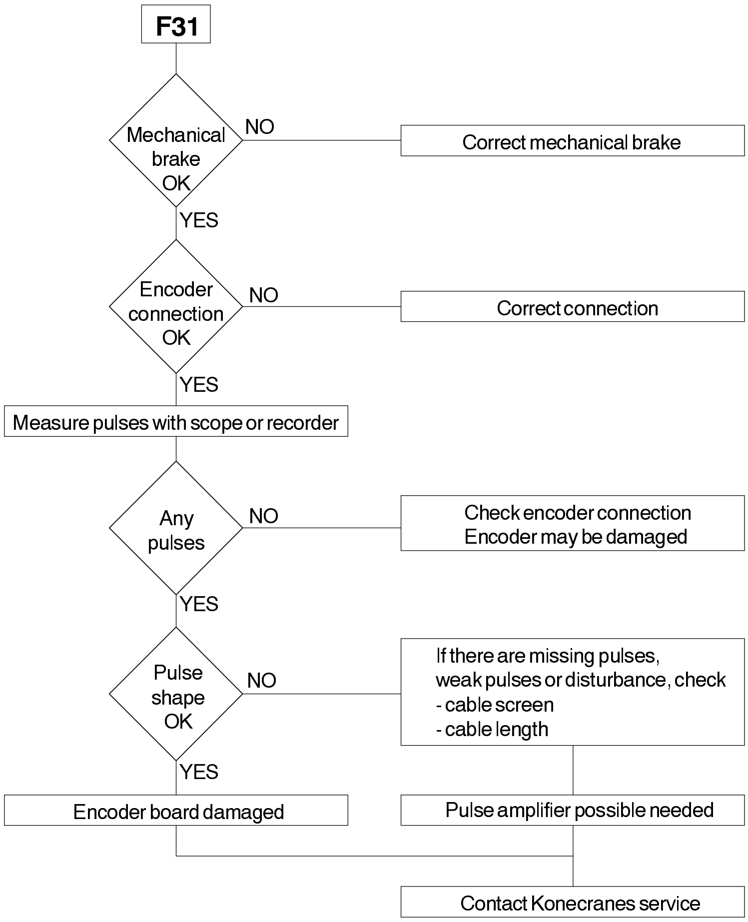
F21 24V supply



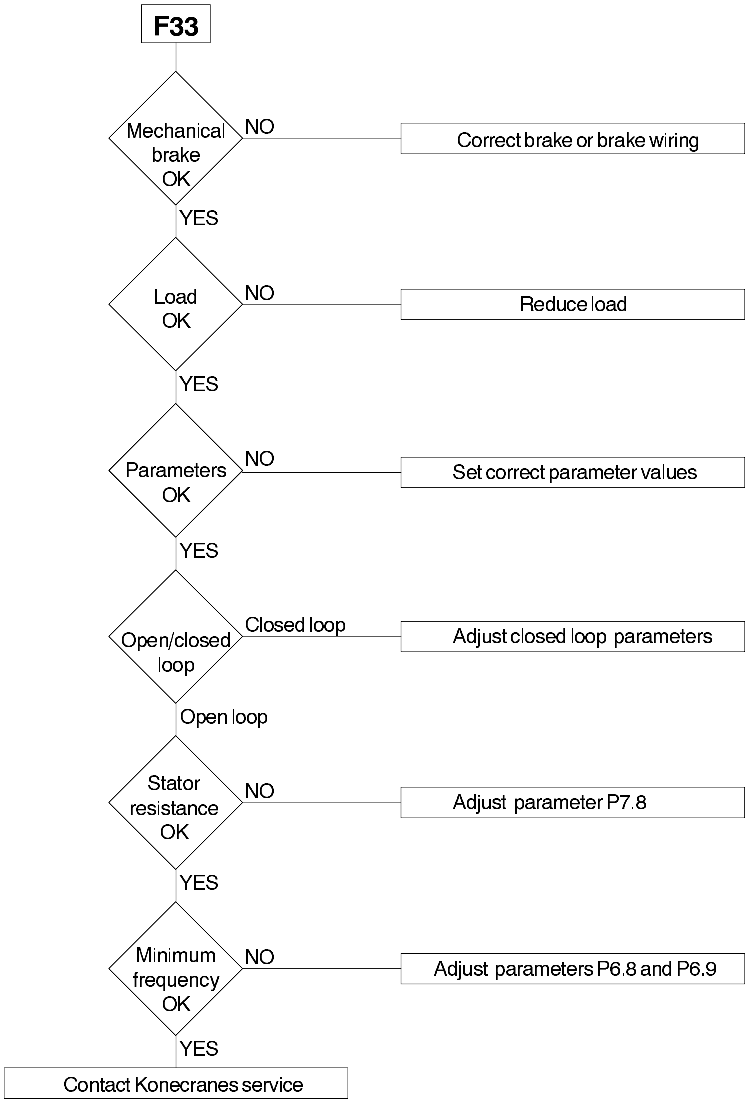
F29 Thermistor fault



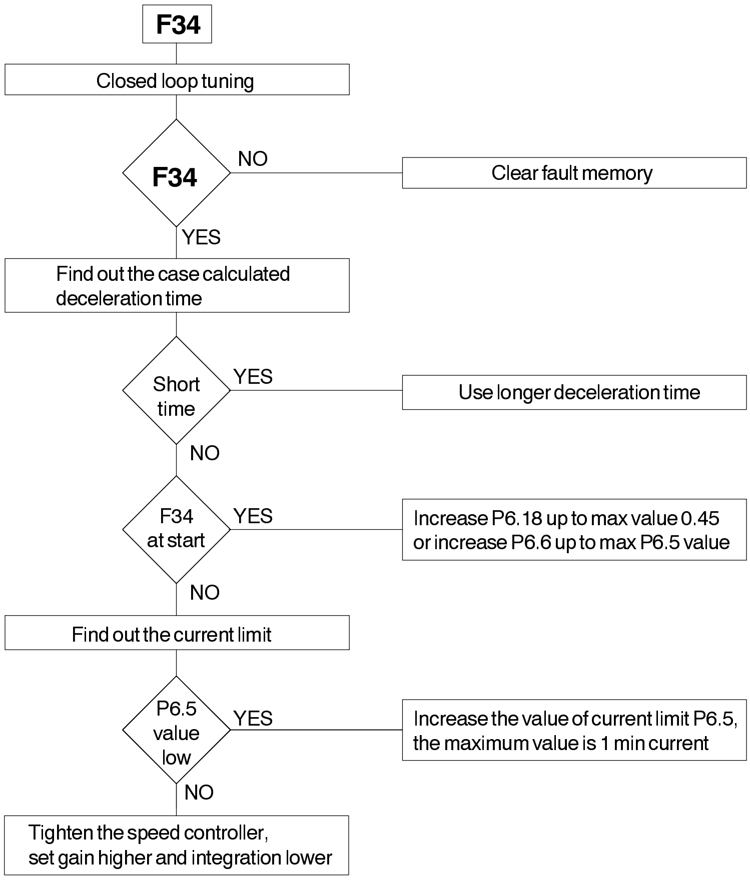
F31 Encoder no pulse



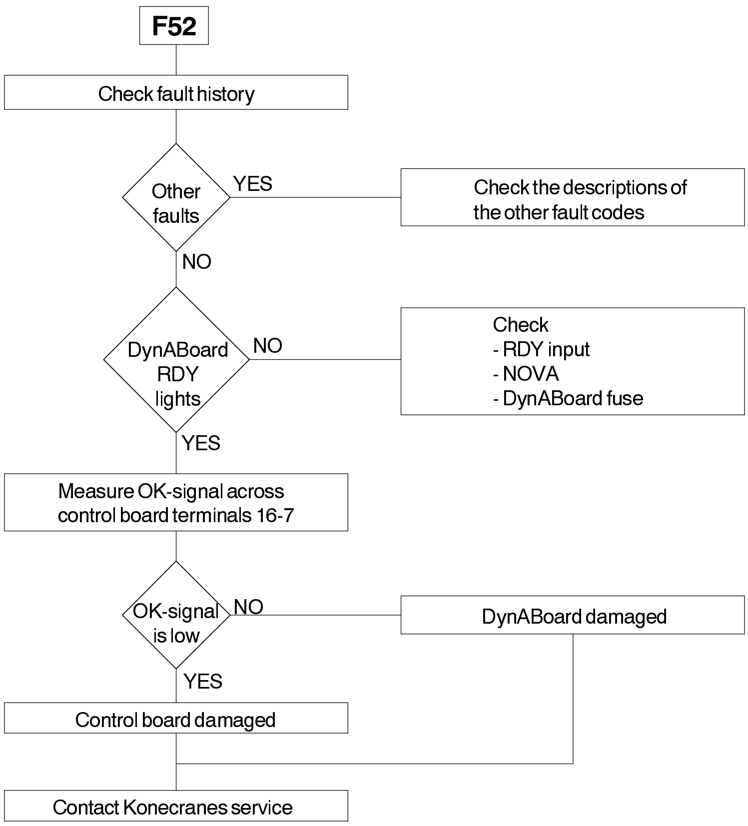
F33 I²t and current cutter supervision



F34 Generator side current limit (closed loop)



F52 External stop



5.2 Field repair actions

The purpose of troubleshooting and field repair actions is primarily to determine whether the problems are in fact caused by DynAC or external devices. After that the next step is to detect the possibly damaged components inside DynAC. If any damage inside DynAC is caused by the environment (motor failure, brake failure, power supply problems etc.) it is very important to repair/change faulty items to prevent further damage.

Field repair is limited to changing the faulty components. Components of DynAC are listed in "Parts list". The spare parts list (Appendix A17) lists components for all DynAC models.

The best way to repair a faulty inverter is to replace it with a new one. If the fault can be located, it is also possible to replace some of the inverter components. Always, if any power component inside the inverter is damaged, it is also recommended to change the component that controls the damaged component. In the smallest models, replacing components except for the PC-boards is not recommended due to cost. When replacing an inverter or a PC-board with a new one, the parameter list of the existing DynAC is needed so that the parameter settings can be copied from the existing DynAC.

If parameters have been copied to the graphical display panel before damage, it may be used for uploading the parameters to the spare part inverter.

See troubleshooting for inverter in Appendix A2.

Appendix A1 Technical data

DynAC V	**2.2J**	**3.0J**	**4.0J**	**5.5J**	**7.5J**	**11J**	**15J**	**18.5J**	**22J**	**30J**	**37J**	**45J**	
Power (kVA) at 230V	4	5	6.5	9	12	17	23	28	33	45	55	65	
Output current In (A)	10	13	16	22	30	43	57	70	83	113	139	165	
Max. output current 1min (A)	15	20	24	33	45	64	85	105	124	169	208	247	
DynAC V	**2.2F**	**3.0F**	**4.0F**	**5.5F**	**7.5F**	**11F**	**15F**	**18.5F**	**22F**	**30F**	**37F**	**45F**	
Power (kVA) at 400V	4.5	5.5	7	9	13	17	22	29	33	40	50	60	
Output current In (A)	6.5	8	10	13	18	24	32	42	48	60	75	90	
Max. output current 1min (A)	10	12	15	20	27	36	48	63	72	90	113	135	
DynAC V	**55F**	**75F**	**90F**	**110F**	**132F**	**160F**	**200F**	**250F**	**315F**	**400F**	**500F**	**630F**	**800F**
Power (kVA) at 400V	75	100	120	150	190	230	280	350	415	520	580	725	920
Output current In (A)	110	150	180	210	270	325	410	510	600	750	840	1050	1330
Max. output current 1min (A)	165	225	270	315	405	485	615	765	900	1000[#]	1200[#]	1400[#]	1600[#]
DynAC V	**2.2K**	**3.0K**	**4.0K**	**5.5K**	**7.5K**	**11K**	**15K**	**18.5K**	**22K**	**30K**	**37K**	**45K**	
Power (kVA) at 575V	3.5	4.5	5.5	7.5	10	14	19	23	26	35	40	50	
Output current In (A)	3.5	4.5	5.5	7.5	10	14	19	23	26	35	42	52	
Max. output current 1min (A)	5.5	7	8.5	11	15	21	29	34	40	53	63	78	
DynAC V	**55K**	**75K**	**90K**	**110K**	**132K**	**160K**	**200K**	**250K**	**315K**	**400K**	**500K**	**630K**	
Power (kVA) at 575V	60	85	100	120	145	185	220	285	325	400	490	620	
Output current In (A)	62	85	100	122	145	185	222	287	325	400	490	620	
Max. output current 1min (A)	93	127	150	183	218	277	333	430	487	560[#]	680[#]	780[#]	

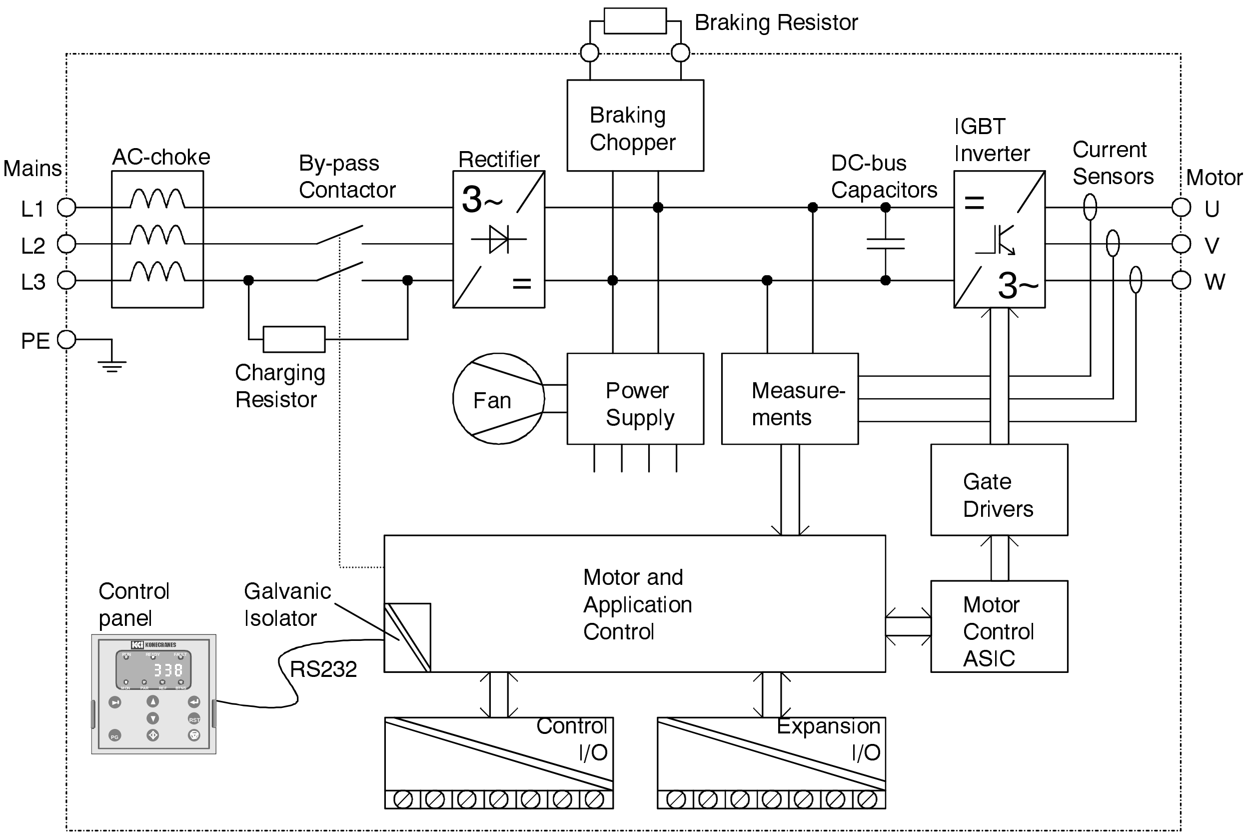
Overloadability	1.5 x In , 1min/10min / 2.5 x In , 2s/20s (<50% speed) [#] Lower overloadability with marked models
Max. output voltage	Equal to supply voltage
Supply	
Supply voltage	J-series 200-240VAC, F-series 380-500VAC, K-series 525-690VAC
Allowable supply voltage fluctuation	+/- 10%
Nominal supply frequency	50/60Hz +/- 5%
Signal input levels	
Digital controls	S1, S2, AP, CMS, FWE, MFI, S11, S12, S21, S22: 15mA; 48/115/230VAC
Analog references	MS, AS and KR: 200kΩ; 0-10V; accuracy 0.5%
Encoder feedback	EA+/- and EB+/-; 3kΩ; 0/24V; floating differential inputs
Control features	
Control method	Frequency control, open loop or closed loop vector control (option board)
Frequency control range	0 … 120Hz
Frequency command	Potentiometer, motor potentiometer, 2-4-step controller or 0 … 10V analog signal
Limit switch functions	Slowdown and stop limit inputs for both directions
Speed control range	Frequency control, open loop vector control s_N … 100% (s_N= motor nominal slip) Closed loop vector control 0 … 100%
Speed accuracy	Frequency control Proportional to the slip of the motor Open loop vector control 1% of nominal speed at speed range 10 … 100% 1/3 of motor nominal slip at speed below 10% Closed loop vector control 0.01% of nominal speed
Extended speed range	100 … 200%
Braking torque	125% (ED10% with standard resistors, ED100% with external resistors)
Protections	
Stall prevention	During acceleration and constant speed
Motor overload protection	Thermistor based temperature measurement
Overload protection	Fault is detected if the current momentarily exceeds 280% of rated current
Undervoltage / blown fuse	Fault is detected if DC voltage drops below 65% of rectified supply voltage
Overvoltage protection	Fault is detected if DC voltage exceeds 437V (J-), 911V (F-), 1258V (K-series)
Momentary power loss	Immediate fault stop
Inverter overtemperature	Temperature sensor on the heat sink
Control voltage transformer	Primary: circuit breaker, secondary: fuse
Mechanical brake	Circuit breaker
Braking transistor	Electronic supervision
Ground fault	Provided by electronic circuitry
Ambient conditions	
Ambient temperature	-10°C … +55°C (14°F … 131°F) for ED≤60%
Storage temperature	-40°C … +60°C (-31°F … 140°F) dry
Humidity	<95%RH (no condensation)
Altitude	Maximum 1000m at In. Above 1000m: In reduces 1% per each 100m. Above 3000m: consult factory.
Vibration	Operation: maximum displacement amplitude 3mm at 2-9Hz. Maximum acceleration amplitude 0.5G ($5 m/s^2$) at 9-200Hz

Conforms to LV and EMC directives.

Appendix A2 Inverter

Warning!	**High voltages inside DynAC. Wait for at least five minutes after the supply voltage has been switched off before service actions. Display in operating condition (lights on) indicates a dangerous voltage on the DC-bus. When display turns off, the DC-bus voltage is about 100V. Before measuring the inverter power circuit components measure that the DC-bus voltage has dropped to zero.**

Principal main circuit diagram of the inverter is shown below. Only the most essential components are described. The exact configuration varies according to the inverter power rating class and voltage class. For example the main circuit of models 110F-400F consists of 2 to 4 branches, which are connected in parallel at mains input and motor output.



In inverter power classes up to 90F, 45J, 75K, the inverter PC-boards are located below the display panel. The expansion board is located at the top, the control board is located in the middle and the power board is the bottommost board to be near the main circuit transistors. The bigger power classes up from 110F and 90K have an additional power board and auxiliary control board for each existing branch.

First check troubleshooting of inverter

Check external protection circuits, fuses and fault history.

Display is blank and inverter does not function

- supply line phases missing
  - a missing phase may prevent the operation of control electronics power supply, otherwise either inverter does not go to READY state or becomes input line supervision fault code F10
- 24 Vdc output overloaded or short circuited
  - internal power disabled, protected by current limit supervision
- faulty display panel
- display panel cable damaged
- faulty power board
- charging resistor damaged
  - braking resistor shorted to ground
  - one supply phase connected to braking resistor terminal

Panel reading is "Ac on", but motor will not run

- panel faulty
- panel frame cable damaged
- faulty control board (spare part PC-board must be factory pre-programmed to the correct power class)
- check panel control (panel / remote / bus)

Input signals from DynABoard have no effect

- the active control location may be display panel instead of terminals
- check values of input signal parameters
- check that all connections to inverter are according to circuit diagram
- faulty control board (spare part PC-board must be factory pre-programmed to the correct power class)

Inverter does not go to READY state

On LED display panel READY indicator is off.
On graphical display panel READY text is not displayed.

- supply voltage is not correct
- one supply line phase is missing
- inverter's supply voltage selection has not been programmed correctly
- some fault has not been reset (FAULT indicator is on)
- if fault does not reset, the fault still exists

Braking does not function

- braking resistor is broken or not connected

Motor runs poorly

- check that all cables are connected and the junctions are reliable
- check that all motor depending parameters are correct
- check the inverter software version
- check encoder operation (closed loop applications only)

Inverter does not accept new parameter value

- parameters are locked, see parameter list for protection level of each parameter
- parameter change must be saved by ENTER button
- check that parameter value is inside the limits
- the parameter can not be changed in RUN state

Parameters

- the parameters are saved to EEPROM, which keeps the parameters in memory after power off without any battery backup
- if inverter parameter memory has lost the correct parameter values, F53 will occur. Re-adjust all parameters. If parameters change again, replace the control board.

Motor will not run

- check that RUN and READY indicators turn on
- read motor output current by monitoring item n3
  - check the cabling from motor and brake to DynAC
  - motor may be stalled
  - check that all motor dependent parameters are correct
- read output frequency value from display panel
  - check maximum frequency setting

Checking and testing inverter after repair

- check the power class of the power board
- check all internal connections
  - check all IGBT gate wires a second time
- set motor dependent parameters
  - check control board power class by monitoring item n24
  - check and record the monitoring values
- run DynAC first without motor (motor control mode parameter P6.15 must be set "0" for this test), then with unloaded motor and finally with loaded motor
  - run normal crane test routine with loads

Component measurements

Supply fuses (in models 110F - 800F, 90K - 630K):
Resistance measuring range. If the fuse is OK, measurement will indicate a short circuit. If a supply fuse has blown, at least one of the main circuit transistors has been damaged. In addition to changing the damaged transistor it is also necessary to change the other transistor(s) of the same phase, because it may have also been damaged during the short circuit.

Charging resistor with diode rectifier and bypass contactor :
Resistance measuring range. Resistance will depend on the inverter power rating class.

Power class		Resistor	Quantity
4.0F - 5.5F		100Ω	1
7.5F - 15F	4.0J - 7.5J	50Ω	1
18.5F - 45F	11J - 22J	33Ω	1
55F - 90F	30J - 45J	25Ω	1
110F - 160F		25Ω	2 (1 per each branch)
200F - 250F		25Ω	3 (1 per each branch)

Charging resistor with thyristor rectifier:
Resistance measuring range. Resistance will depend on the inverter power rating class.

Power class		Resistor	Quantity
	4.0K - 75K	100Ω	3 (1 per phase)
	90K - 132K	50Ω	6 (1 per phase in each branch)
	160K - 200K	50Ω	6 (1 per phase in each branch)
315F - 400F	250K - 315K	50Ω	12 (1 per phase in each branch)
500F	400K	50Ω	18 (1 per phase in each branch)
630F - 800F	500K - 630K	50Ω	24 (1 per phase in each branch)

Rectifier thyristors:
Resistance measuring range. The resistances should be measured between

gate and cathode	5 - 50Ω
gate and anode	>500kΩ
anode and cathode	>500kΩ

Main circuit diodes:
Diode measuring range. Forward threshold voltage of diode should be 0.3-0.6VDC. When measuring reverse voltage multimeter indicates maximum voltage (= open circuit).

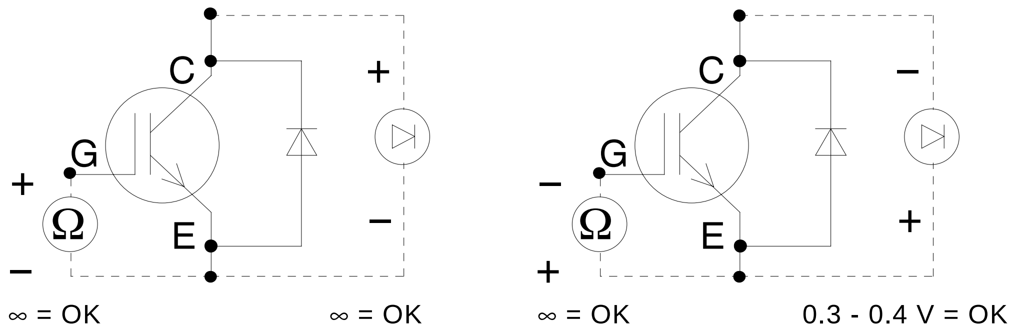
Main circuit transistors:
If inverter fault display is F1 "Overcurrent" or F4 "Inverter fault" immediately after power on or direction command, the fault may be in IGBT-modules. In the following measurements the DC-bus voltage must be absolutely 0V, otherwise measurements are not reliable.

Basic IGBT test

The output stage has IGBT-modules, which are equipped with free-wheeling diodes (see figure below).

Resistance measuring range
- Multimeter should indicate infinite when measured between gate (G) and emitter (E).

Diode measuring range
- Multimeter should indicate infinite when measured between collector (C) and emitter (E) (positive lead is connected to C and negative lead to E).
- When meter leads are reversed, meter should indicate the threshold voltage of the free-wheeling diode.



Device specific IGBT test

In some models measuring the IGBT-modules directly is not possible without taking the inverter apart. Thus it is easier to measure the IGBT modules using diode and capacitance tests. Disconnect the motor cable and the measurement procedure can be done as follows:

IGBT free-wheeling diode test

- Set multimeter to diode measuring range.

IGBT-bridge lower transistors

- Connect the multimeter red lead (+) to DC-bus minus bar.
- Measure by touching the black lead (-) to each motor phases.
- On all phases, the forward threshold voltage of diode should be 0.3-0.4VDC.
- Reverse the multimeter leads and measure again.
- In reverse measurement the diodes must not conduct.

IGBT-bridge upper transistors

- Connect the multimeter black lead (-) to braking resistor plus terminal (+).
- Measure by connecting the red lead (+) against all motor phases.
- At all phases the forward threshold voltage of diode should be 0.3-0.4VDC.
- Change the multimeter leads opposite and measure again.
- In reverse measurement the diodes must not conduct.

IGBT transistor test

- Set multimeter to capacitance measuring range.

IGBT-bridge U-phase transistors

- Disconnect power board connector X-9 (U-phase) and measure the capacitance between black and red wires of plug.
- Next measure the capacitance between grey and white wires of plug.
- The result of the measurement must be same in both cases (reversing multimeter leads may give different result).

IGBT-bridge V-phase and W-phase transistors

- Measure connectors X-11 (V-phase) and X-13 (W-phase) as above. The results must be equal to U-phase.

Analyze of capacitance measurement results

- A big difference between phases probably is caused by a broken transistor.
- The result can be different between black-red and grey-white pairs in one phase, but differences between U-V-W -phases are not allowed.
- If capacitance is very small, or no capacitance at all, the wire may be broken or the gate has burned out. Correct result should be 5nF...120nF depending on inverter power class.

Inverter main spare parts for J-series

Order code / Material number	Description	Type	Technical data	POWER RATING / NUMBER OF PARTS 0022J	0030J	0040J	0055J	0075J	0110J	0150J	0185J	0220J	0300J	0370J	0450J
DISPLAY PANELS															
450130	7-segment LED panel	DAV-1L		1	1	1	1	1	1	1	1	1	1	1	1
450131	Graphical LCD panel	DAV-1G		1	1	1	1	1	1	1	1	1	1	1	1
BOARDS															
450132	Expander Board	DAV-B1P		1	1	1	1	1	1	1	1	1	1	1	1
450133	Encoder Board	DAV-B1N		1	1	1	1	1	1	1	1	1	1	1	1
450172	Profibus-DP Board	DAV-B1U		1	1	1	1	1	1	1	1	1	1	1	1
DAV-B062-Jxxxx	Control Board (4M)		xxxx = power class	1	1	1	1	1	1	1	1	1	1	1	1
DAV-B003-JxxxxS	Power Board			1	1	1	1	1	1	1	1	1	1	1	1
DAV-B048-J	IGBT Connection Board			1	1	1	1	1							
DAV-B005-Jxxxx	Adapter Board			1	1										
DAV-B006-Jxxxx	Adapter Board					1	1	1							
DAV-B007-Jxxxx	Adapter Board								1	1	1	1			
DAV-B008-Jxxxx	Adapter Board												1	1	1
COOLING FANS															
DAV-E101-G	Fan	PUDC24Z4	80mm, 24VDC	1		1									
DAV-E105-G	Fan	W2G076-BC31-12	80mm, 24VDC		1										
DAV-E102-G	Fan	MC24B3	120mm, 24VDC				1	1	1						
DAV-E103-G	Fan	Major JG 24 B3	150mm, 24VDC							1	1	1			
DAV-E110-G	Fan	D2E133-DM47	230VAC										1	1	1
RECTIFIERS															
DAV-S208-G	Rectifier	SKD31/16	6*31A/1600V	1	1										
DAV-S204-G	Rectifier	SKD82/16	6*82A/1600V						1						
DAV-S205-G	Rectifier	SKD110/16	6*110A/1600V							1					
DAV-S206-G	Rectifier	SKD160/16	6*160A/1600V								1	1			
DAV-S207-G	Rectifier	SKKD162/16	2*162A/1600V										3	3	3
BRAKING TRANSISTOR IGBT MODULES															
DAV-S251-G	IGBT	SKM40GDL123D	7*40A/1200V	1	1										
DAV-S252-G	IGBT/Rectifier	SKD100GAL123D	1+6*100A/1600V			1	1	1							
DAV-S253-G	IGBT	SKM195GAL123D	1*195A/1200V						1	1	1	1	2	2	2
MOTOR BRIDGE IGBT MODULES															
DAV-S414-G	IGBT	SKM60GD062DL	2*60A/600V	1	1	1									
DAV-S415-G	IGBT	SKM100GD062DL	2*100A/600V				1	1							
DAV-S416-G	IGBT	SKM200GD062DK	2*200A/600V						1	1	1	1			
DAV-S417-G	IGBT	SKM200GB062D	2*200A/600V										3	3	
DAV-S418-G	IGBT	SKM400GB062D	2*400A/600V												3
BUSBARS															
DAV-M618-J	Busbars for DAV0022J-0030J			1	1										
DAV-M619-J	Busbars for DAV0040J-0075J					1	1	1							
DAV-M620-J	Busbars for DAV0110J-0220J								1	1	1	1			
DAV-M621-J	Busbars for DAV0300J-0450J												1	1	1
CURRENT SENSORS															
DAV-E821-G	Current Sensor	LEM 205-S	200A						3	3	3	3			
DAV-E822-G	Current Sensor	LEM 305-S	300A										3	3	
DAV-E823-G	Current Sensor	LEM 305-S/SP1	300A												3
CHEMICALS															
DAV-M901-G	Thermal compound	Paste 12	150g tube	X	X	X	X	X	X	X	X	X	X	X	X

Inverter main spare parts for F-series

POWER RATING / NUMBER OF PARTS

Order code / Material number	Description	Type	Technical data	0022F	0030F	0040F	0055F	0075F	0110F	0150F	0185F	0220F	0300F	0370F	0450F	0550F	0750F	0900F	1100F	1320F	1600F	2000F	2500F	3150F	4000F	5000F	6300F	8000F
DISPLAY PANELS																												
450130	7-segment LED panel	DAV-1L		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
450131	Graphical LCD panel	DAV-1G		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
BOARDS																												
450132	Expander Board	DAV-B1P		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1										
450133	Encoder Board	DAV-B1N		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
450172	Profibus-DP Board	DAV-B1U		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
DAV-B062-Fxxxx	Control Board (4M)		xxxx = power class	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
DAV-B119-F	Auxiliary Control Board																		1	1	1	2	2	3	3			
DAV-B103-F	Master Auxiliary Control Board																									2	3	3
DAV-B119-F	Slave Auxiliary Control Board																									2	3	3
DAV-B104-F	Master Repeater																									1	1	1
DAV-B105-F	Slave Repeater																									1	1	1
DAV-B002-FxxxxS	Power Board		xxxx = power class	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1										
DAV-B020-FxxxxS	Power Board																		2	2	2	3	3			3		
DAV-B055-FxxxxS	Power Board																							4	4		4	4
DAV-B110-FxxxxS	Slave Power Board																										4	4
DAV-B112-FxxxxS	Slave Power Board																									3		
DAV-B048-F	IGBT Connection Board			1	1	1	1	1	1	1																		
DAV-B080-F	VRD Board																							4	4		8	8
DAV-B005-Fxxxx	Adapter Board		xxxx = power class	1	1	1	1																					
DAV-B006-Fxxxx	Adapter Board							1	1																			
DAV-B009-Fxxxx	Adapter Board									1																		
DAV-B007-Fxxxx	Adapter Board										1	1	1	1	1													
DAV-B008-Fxxxx	Adapter Board															1	1	1	2	2	2	3	3	4	4	6	8	8
DAV-B018-F	Branching Board																		1	1	1	1	1	1	1	2	2	2
FUSES																												
DAV-E081-G	Fuse	170M1372	315A 660V 00/P																	6	6	9	9	12	12	18	24	24
DAV-E082-G	Fuse	170M1371	250A 660V 00/P UR																6									
COOLING FANS																												
DAV-E101-G	Fan	PUDC24Z4	80mm, 24VDC	1	1	1		1																				
DAV-E105-G	Fan	W2G076-BC31-12	80mm, 24VDC				1																					
DAV-E102-G	Fan	MC24B3	120mm, 24VDC						1	1	1	1	1															
DAV-E103-G	Fan	Major JG 24 B3	150mm, 24VDC											1	1													
DAV-E104-G	Fan	D2E133-AM47	220VAC													1	1	1			2							
DAV-E110-G	Fan	D2E133-DM47	230VAC																1	1								
DAV-E109-G	Fan	D2E146-CD51-09	220VAC																			3	3	4	4	6	8	8
RECTIFIERS																												
DAV-S201-G	Rectifier	SKD25/16	6*25A/1600V	1	1	1																						
DAV-S208-G	Rectifier	SKD31/16	6*31A/1600V				1																					
DAV-S204-G	Rectifier	SKD82/16	6*82A/1600V								1	1																
DAV-S205-G	Rectifier	SKD110/16	6*110A/1600V										1															
DAV-S206-G	Rectifier	SKD160/16	6*160A/1600V											1	1													
DAV-S207-G	Rectifier	SKKD162/16	2*162A/1600V													3	3	3	6	6	6	9	9			18		
DAV-S209-G	Thyristor/Rectifier	SKKH162/16	1+1*162A/1600V																					12	12		24	24
BRAKING TRANSISTOR IGBT MODULES																												
DAV-S251-G	IGBT	SKM40GDL123D	7*40A/1200V	1	1	1	1																					
DAV-S252-G	IGBT/Rectifier	SKD100GAL123D	1+6*100A/1200V					1	1	1																		
DAV-S253-G	IGBT	SKM195GAL123D	1*195A/1200V								1	1	1	1	1	2	2	2	4	4	4	6	6	8	8	12	16	16
MOTOR BRIDGE IGBT MODULES																												
DAV-S403-G	IGBT	SKM50GB123D	2*50A/1200V					3																				
DAV-S404-G	IGBT	SKM75GB123D	2*75A/1200V						3																			
DAV-S405-G	IGBT	SKM100GB123D	2*100A/1200V							3																		
DAV-S406-G	IGBT	SKM150GB123D	2*150A/1200V								3	3	3															
DAV-S407-G	IGBT	SKM200GB123D	2*200A/1200V											3	3				6									
DAV-S408-G	IGBT	SKM300GB123D	2*300A/1200V													3	3			6		9		12			24	
DAV-S409-G	IGBT	SKM400GB123D	2*400A/1200V															3			6		9		12	18		24
BUSBARS																												
DAV-M601-F	Busbars for DAV0022F-0055F			1	1	1	1																					
DAV-M602-F	Busbars for DAV0075F-0150F							1	1	1																		
DAV-M604-F	Busbars for DAV0185F-0450F										1	1	1	1	1													
DAV-M606-F	Busbars for DAV0550F-0900F															1	1	1										
DAV-M608-F	Busbars for DAV1100F-1600F																		1	1	1							
DAV-M610-F	Busbars for DAV2000F-2500F																					1	1			2		
DAV-M612-F	Busbars for DAV3150F-4000F																							1	1		2	2
CURRENT SENSORS																												
DAV-E821-G	Current Sensor	LEM 205-S	200A								3	3	3	3	3													
DAV-E822-G	Current Sensor	LEM 305-S	300A													3	3		6	6		9		12			24	
DAV-E823-G	Current Sensor	LEM 305-S/SP1	300A															3			6		9		12	18		24
CHEMICALS																												
DAV-M901-G	Thermal compound	Paste 12	150g tube	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

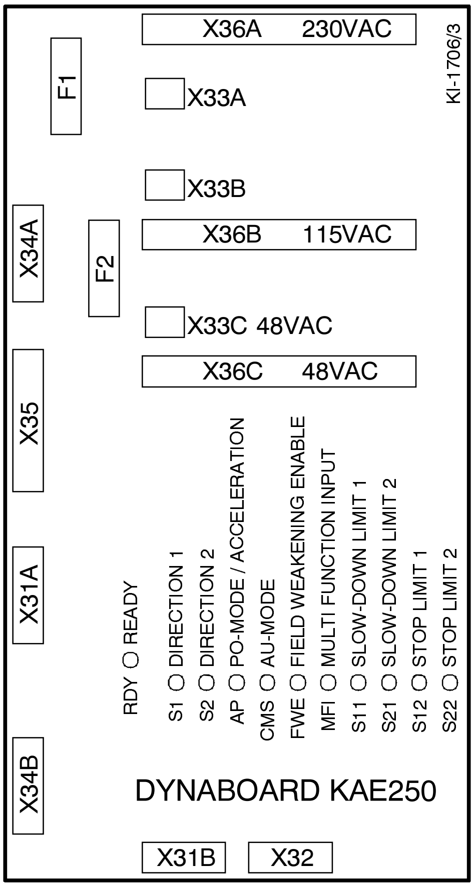
Inverter main spare parts for K-series

POWER RATING / NUMBER OF PARTS

Order code / Material number	Description	Type	Technical data	0022K	0030K	0040K	0055K	0075K	0110K	0150K	0185K	0220K	0300K	0370K	0450K	0550K	0750K	0900K	1100K	1320K	1600K	2000K	2500K	3150K	4000K	5000K	6300K
DISPLAY PANELS																											
450130	7-segment LED panel	DAV-1L		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
450131	Graphical LCD panel	DAV-1G		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
BOARDS																											
450132	Expander Board	DAV-B1P		1	1	1	1	1	1	1	1	1	1	1	1	1	1										
450133	Encoder Board	DAV-B1N		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
450172	Profibus-DP Board	DAV-B1U		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
DAV-B062-Kxxxx	Control Board (4M)		xxxx = power class	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
DAV-B119-K	Auxiliary Control Board																	1	1	1	2	2	3	3			
DAV-B103-K	Master Auxiliary Control Board																								2	3	3
DAV-B119-K	Slave Auxiliary Control Board																								2	3	3
DAV-B104-K	Master Repeater																								1	1	1
DAV-B105-K	Slave Repeater																								1	1	1
DAV-B010-KxxxxS	Power Board		xxxx = power class	1	1	1	1	1	1	1	1	1	1	1	1	1	1										
DAV-B042-KxxxxS	Power Board																	2	2	2	3	3	4	4	3	4	4
DAV-B111-KxxxxS	Slave Power Board																								3	4	4
DAV-B080-K	VRD Board																	2	2	2	3	3	4	4	6	8	8
DAV-B006-Kxxxx	Adapter Board		xxxx = power class	1	1	1	1	1	1	1	1																
DAV-B009-Kxxxx	Adapter Board											1															
DAV-B007-Kxxxx	Adapter Board												1	1	1	1	1										
DAV-B008-Kxxxx	Adapter Board																	2	2	2	3	3	4	4	6	8	8
DAV-B018-F	Branching Board																	1	1	1	1	1	1	1	2	2	2
FUSES																											
DAV-E082-G	Fuse	170M1371	250A 660V 00/P UR															6	6	6	9	9	12	12	18	24	24
COOLING FANS																											
DAV-E101-G	Fan	PUDC24Z4	80mm, 24VDC	1	1	1	1	1	1	1																	
DAV-E102-G	Fan	MC24B3	120mm, 24VDC								1	1	1	1	1	1											
DAV-E103-G	Fan	Major JG 24 B3	150mm, 24VDC														1										
DAV-E110-G	Fan	D2E133-DM47	230VAC															1	1								
DAV-E104-G	Fan	D2E133-AM47	220VAC																	2							
DAV-E109-G	Fan	D2E146-CD51-09	220VAC																		3	3	4	4	6	8	8
RECTIFIERS																											
DAV-S210-G	Thyristor/Rectifier	SKKH57/20	1+1*57A/2000V	3	3	3	3	3	3	3	3	3	3	3	3												
DAV-S211-G	Thyristor/Rectifier	SKKH72/20	1+1*72A/2000V													3	3										
DAV-S212-G	Thyristor/Rectifier	SKKH162/18E	1+1*162A/1800V															6	6	6	9	9	12	12	18	24	24
BRAKING TRANSISTOR IGBT MODULES																											
DAV-S256-G	IGBT	SKM100GAL173D	1*100A/1700V	1	1	1	1	1	1	1	1	1															
DAV-S257-G	IGBT	SKM200GAL173D	1*200A/1700V										1	1	1	1	1	2	2	2	3	3	4	4	6	8	8
MOTOR BRIDGE IGBT MODULES																											
DAV-S410-G	IGBT	SKM75GB173D	2*75A/1700V	3	3	3	3	3	3	3	3																
DAV-S411-G	IGBT	SKM100GB173D	2*100A/1700V									3	3														
DAV-S412-G	IGBT	SKM150GB173D	2*150A/1700V											3	3			6	6		9						
DAV-S413-G	IGBT	SKM200GB173D	2*200A/1700V													3	3			6		9	12	12	18	24	24
BUSBARS																											
DAV-M613-K	Busbars for DAV0022K-0220K			1	1	1	1	1	1	1	1	1															
DAV-M614-K	Busbars for DAV0300K-0750K												1	1	1	1	1										
DAV-M615-K	Busbars for DAV0900K-1320K																	1	1	1							
DAV-M616-K	Busbars for DAV1600K-2000K																				1	1			2		
DAV-M617-K	Busbars for DAV2500K-3150K																						1	1		2	2
CURRENT SENSORS																											
DAV-E821-G	Current Sensor	LEM 205-S	200A										3	3	3	3	3										
DAV-E822-G	Current Sensor	LEM 305-S	300A															6	6	6	9	9	12	12	18	24	24
CHEMICALS																											
DAV-M901-G	Thermal compound	Paste 12	150g tube	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Appendix A3 DynABoard

Warning!	**Dangerous high voltage in DynABoard: 48V, 115V or 230V**



DynABoard KAE250 is compatible with all DynAC and DynAHoist power classes. The main functions are:

- I/O interface
- power source for reference potentiometer

DynABoard can be connected alternatively to three different control voltages:

X36A	230Vac external control voltage
X36B	115Vac external control voltage
X36C	48Vac from internal transformer or 48Vac external control voltage

The inputs of X36 (10pcs) are protected by a common fuse F1. In addition all inputs are protected separately by a varistor.

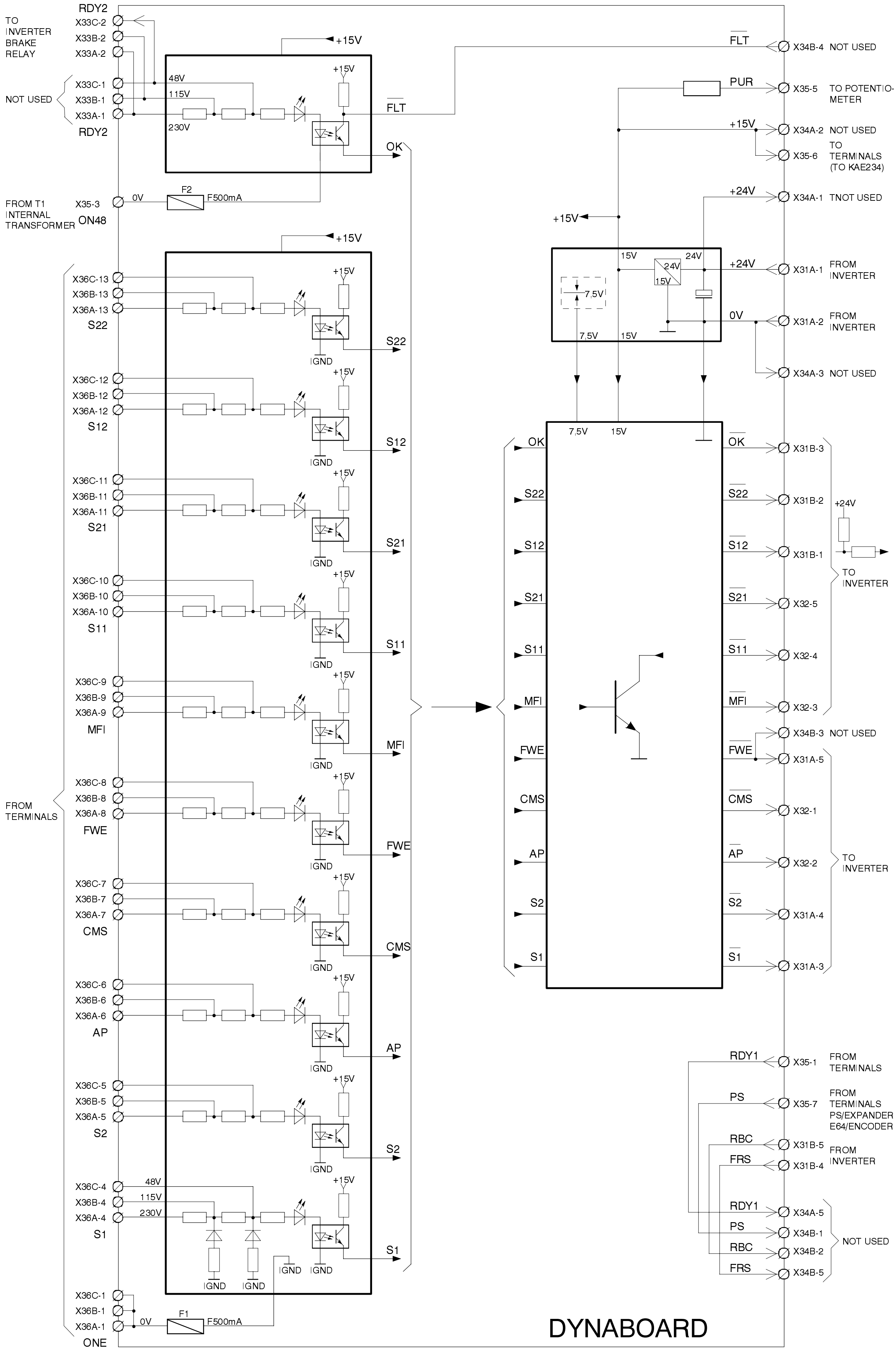
Note!	**The control voltage selection of terminals X36 A, B and C must be checked before switching the power on.**

The control voltage of RDY input (X33) is 48V, which must be taken from the DynAC internal control transformer (as well as ES signal). This is because these signals control 48V coils of DynAC line and brake contactors.

RDY input is protected by fuse F2 and a varistor. RDY signal goes through DynABoard with names "RDY1" and "RDY2". From this signal the inverter gets "OK" signal. Other input signals go through DynABoard with identical signal names.

Note!	**In DynAC standard models the voltage selection of DynABoard terminals X33 A, B and C must always be set to 48V (C).**

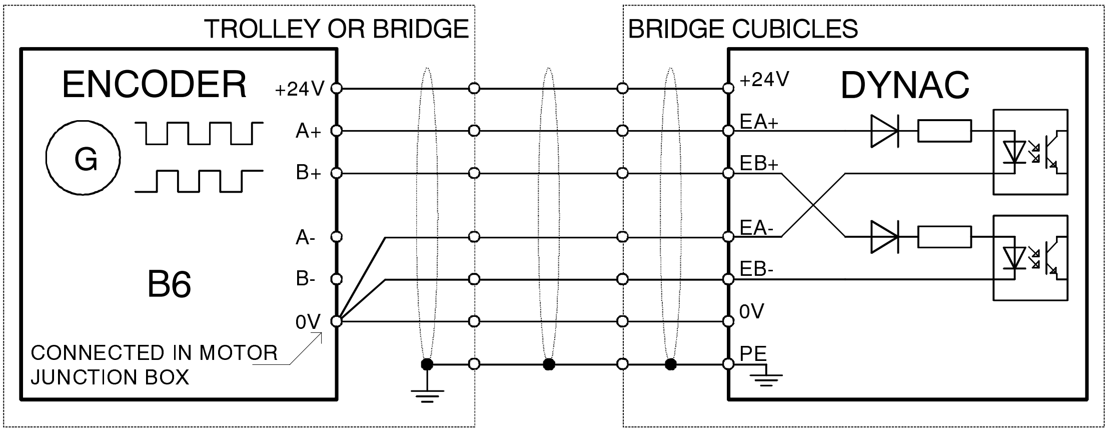
The proper function of DynABoard output signals can be checked most easily by measuring at the inverter input terminals. This can be done with a multimeter on DC-voltage range. Connect the neutral of the meter to inverter terminal X10:3. All output signals are active in the low level state (0V). Signals are not active in the high level state (+24V).


RDY2
TO INVERTER BRAKE RELAY
X33C-2
X33B-2
X33A-2
NOT USED
X33C-1
X33B-1
X33A-1
48V
115V
230V
+15V
FLT
OK
FROM T1 INTERNAL TRANSFORMER
X35-3
ON48
0V
F2
F500mA
X36C-13
X36B-13
X36A-13
S22
S12
S21
S11
MFI
FWE
CMS
AP
S2
S1
IGND
FROM TERMINALS
X36C-1
X36B-1
X36A-1
ONE
F1
PUR
X34B-4 NOT USED
X35-5 TO POTENTIO-METER
X34A-2 NOT USED
X35-6 TO TERMINALS (TO KAE234)
+24V
X34A-1 TNOT USED
X31A-1 FROM INVERTER
X31A-2 FROM INVERTER
X34A-3 NOT USED
7,5V
15V
24V
X31B-3
X31B-2
X31B-1
X32-5
X32-4
X32-3
X34B-3 NOT USED
X31A-5
X32-1
X32-2
X31A-4
X31A-3
TO INVERTER
RDY1
PS
RBC
FRS
X35-1 FROM TERMINALS
X35-7 FROM TERMINALS PS/EXPANDER E64/ENCODER
X31B-5
X31B-4
FROM INVERTER
X34A-5
X34B-1
X34B-2
X34B-5
NOT USED
DYNABOARD

Appendix A4 Encoder connection

An encoder is used with DynAC to obtain excellent speed accuracy and fast response as well as to reach very low minimum speeds.

An encoder connection example is shown below. Power supply from the DynAC (+24V, 0V) is connected to the respective encoder terminals. Both input channels (EA, EB) of the DynAC are "floating" inputs to reach maximum immunity to noise. The positive terminals of both channels (EA+, EB+) are connected to encoder outputs (A+, B+). The negative terminals are connected to 0V **as close to the encoder as possible** (at the first junction box next to the encoder). All signal wires (EA+, EA-, EB+, EB-) shall be included inside a single shielded cable. Power supply to the encoder may also be included in the same cable.



In many encoders, there are also "inverted outputs (A- , B-)" and "zero outputs (Z+ , Z-)", which should be left disconnected. Signal outputs are often labeled as 1, 1 , 2, 2 , 0 and 0.

In order to avoid fault situations the cable between the encoder and DynAC must be
- placed as far from the motor cables and braking resistor cables as possible (minimum distance >20cm)
- a shielded and twisted cable
- grounded (the shield) at both ends

Some problems may occur when using shielded flat cable or in situations where the encoder cable has been placed too close (< 5cm) to the motor cables and braking resistor cables.

Encoders have been standardized based on cable lengths and maximum speeds of applied motors:

Code	Pulses per revolution	Minimum nominal speed	Motor maximum speed (rpm) at cable length							
	(ppr)	(rpm)	40m	50m	63m	80m	100m	120m	150m	200m
NM701NR3	600	1500	6000	6000	6000	5500	5200	5000	4800	3800
NM701NR1	1000	1000	5000	5000	4600	4100	3700	3300	2900	2300
NM701NR5	1024	1000	5000	5000	4600	4100	3700	3300	2900	2300
NM701NR2	2000	500	2700	2500	2300	2000	1800	1600	1400	1200
NM701NR6	2048	500	2700	2500	2300	2000	1800	1600	1400	1200

Note! Maximum nominal and ESR-speeds above are as allowed by the DynAC itself, but there may be other limiting factors due to mechanical reasons.

Troubleshooting of encoder connections

If the encoder is connected incorrectly or the encoder pulse setting (P8.1) is wrong, the motor may oscillate and it will sound abnormal. Usually either F31 “Encoder no pulse” or F32 “Encoder direction fault” will occur. In this situation also warning code A30 may occur (in models 110F-800F, 90K-630K).

Test encoder operation

- Drive at minimum speed
- See motor speed (rpm) from monitoring item n2
- Speed should be positive to direction 1 and negative to direction 2

If encoder test fails

- Check brake opens
- Check encoder pulse number is equal to P8.1
- Check encoder connections and encoder cables
- Check encoder mechanical connection
- Check cable shields are correctly grounded
- Check cable shield and zero are not wired to same point
- Change channel A+ to terminal EB+ and channel B+ to terminal EA+
- Check that A-, B-, Z+ and Z- are not connected

In a case where the encoder cable is very long, the encoder pulses can be amplified by two KAE234’s. See DynAHoist Service Manual for more information.

Note!	**If torque limit is on, faulty encoder connection does not necessarily cause fault codes F31 and F32.**

Appendix A5 Potentiometer specification

A special potentiometer connection is used in the DynAC. End terminals of the potentiometer are short-circuited and connected to terminal X1:33 (0V). Power supply is connected via a series resistor (1.31kΩ) to terminal X1:31 (PUR). The wiper of the potentiometer and X1:31 must be connected externally to X1:32 (MS).

Note that if several DynACs are controlled by a single potentiometer, power supply must be taken from only one of those DynACs. The impedance of the MS input is about 200kΩ, so the MS inputs of the other DynACs can be connected in parallel (maximum four at a time). The inputs should be wired permanently parallel to ensure a constant impedance.

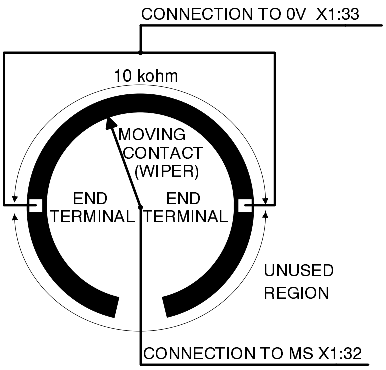
Parameter P3.5 must be 1 to make the DynAC operate properly. P3.6, P3.7, P3.8 and P3.9 settings also have an effect on the frequency reference F_{REF}. See examples below, where MS is voltage at X1:32.

Speed	MS	P3.8	P3.9	F_{REF}
min	10.0V	100%	-100%	0%
max	0V	100%	-100%	100%
min	10.0V	200%	-200%	0%
max	5.0V	200%	-200%	100%
min	10.0V	300%	-300%	0%
max	6.7V	300%	-300%	100%

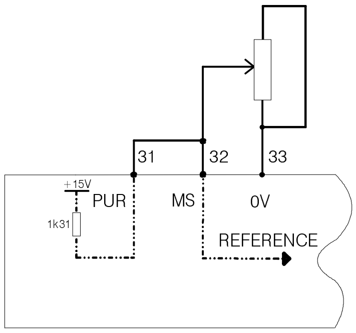
The default values
P3.6 = 0
P3.7 = 0.1s
P3.8 = 300%
P3.9 = -300%

Konecranes has a custom-designed potentiometer for DynAC control. This potentiometer can be used with the same pendant and cabin controllers that are used with DynAHoist and ACE by Konecranes.

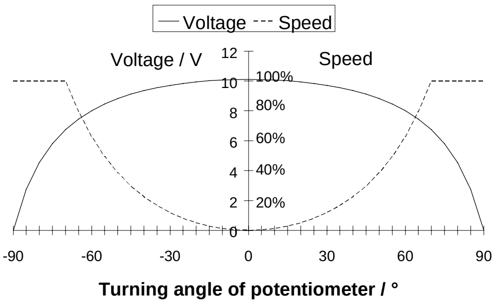
The structure of this potentiometer is shown in the figure below. The active region of the potentiometer is only about 180 degrees, but the length of the resistive element is about 340 degrees. In the middle of the normally unused 180 degrees there is a non-conducting gap. The resistance between the end terminals of the potentiometer is 10kΩ. When the end terminals are short-circuited, the resistance measured between the end terminals and the wiper varies from 2.5-2.8kΩ (wiper in the middle, corresponds to minimum speed) to less than 800Ω (wiper close to end terminal, corresponds to maximum speed). With the above specified potentiometer and default parameter values, the voltage level at the MS-input is 10 to 6.7 volts (0 to 100% speed). Also any other potentiometer-controller combination can be used provided that P3.6, P3.7, P3.8 and P3.9 setting range is sufficient.



Potentiometer construction



Connection



Control voltage and speed as a function of turning angle

Appendix A6 Description of terminals

Note!	**Some of the signals do not exist in all devices depending on power class and model.**

No	Name	Description, signal level	No	Name	Description, signal level
L1	L1	Power supply, phase 1	U	U	Motor output, phase 1
L2	L2	Power supply, phase 2	V	V	Motor output, phase 2
L3	L3	Power supply, phase 3	W	W	Motor output, phase 3
1	BL1	AC brake supply, phase 1 (up from 55F, 90K)	41	BD1	AC brake supply, phase 1
2	BL2	AC brake supply, phase 2 (up from 55F, 90K)	42	BD2	AC brake supply, phase 2
3	BL3	AC brake supply, phase 3 (up from 55F, 90K)	43		
4	RESF	Braking resistor fan, 230Vac	44	ON	Neutral of control voltage OL230, grounded
5	K7-154	Free NO-contact of K7	45	K7-153	Free NO-contact of K7
6	K7-164	Free NO-contact of K7	46	K7-163	Free NO-contact of K7
7	K1-64	Free NO-contact of K1 (up from 30J, 55F, 90K: K01)	47	K1-63	Free NO-contact of K1
8	K71-14	Free NO-contact of K71	48	K71-13	Free NO-contact of K71
9	RD1	Free NO-contact of READY (N-models)	49	RD2	Free NO-contact of READY (N-models)
10	MR1	Free NO-contact of MRO (N-models)	50	MR2	Free NO-contact of MRO (N-models)
11	OLE	External control voltage, 48/115/230Vac	51	ONE	Neutral of external control voltage OLE
12	OLE	External control voltage, 48/115/230Vac	52	ONE	Neutral of external control voltage OLE
13	SE12	Signal S1 continuing	53	FWE	Field weakening enable
14	SE11	Signal S1 continuing	54	MFI	Multi Function Input
15	S1	Direction 1 run command	55	S11	Slowdown signal, direction 1
16	S2	Direction 2 run command	56	S21	Slowdown signal, direction 2
17	AP	Command mode selection/acceleration command	57	S12	Stop limit signal, direction 1
18	CMS	Command mode selection	58	S22	Stop limit signal, direction 2
19			59	S7	Brake pedal
20			60		
21			61		
22			62		
23			63		
24	OL48	Control voltage, 48Vac 50/60Hz	64	ON48	Neutral of control voltage OL48, grounded
25	OL48	Control voltage, 48Vac 50/60Hz	65	ON48	Neutral of control voltage OL48, grounded
26	RDY	Stop with brake	66	K1-A2	Coil of line contactor K1 (up from 30J, 55F, 90K: K01)
27	ES	External stop	67	K7-A2	Coil of brake contactor K7 (up from 55F, 90K: K71)
28	EST	External stop, braking resistor temperature	68		
29			69		
30			70		
31	PUR	Pull-up resistor for potentiometer	71	AOUT	Analog output, range 0...+10V (N-models)
32	MS	Master speed reference, -10...+10V	72	+15V	+15V output (for pulse sensor)
33	0V	Common for analog signals	73	0V	Common for analog signals
34	0V	Common for analog signals	74	PS	Speed sensor input (for pulse sensor)
35	AS	Auxiliary speed reference, 0...+10V	75	+24V	+24V output for encoder
36	KR	Speed reference correction signal, -10...+10V(N-models)	76	EA+	Encoder channel A+ (N-models)
37	T1	Thermistor input	77	EA-	Encoder channel A- (N-models)
38	T2	Thermistor input	78	EB+	Encoder channel B+ (N-models)
39			79	EB-	Encoder channel B- (N-models)
40			80	E64	Encoder output frequency divided by 64 (N-models)
91	L11	Auxliary power supply, phase 1 (K-models)	101		Auxliary power supply, phase 1 (0-models)
92	L12	Auxliary power supply, phase 2 (K-models)	102		Auxliary power supply, phase 2 (0-models)
93	L13	Auxliary power supply, phase 3 (K-models)	103		Auxliary power supply, phase 3 (0-models)

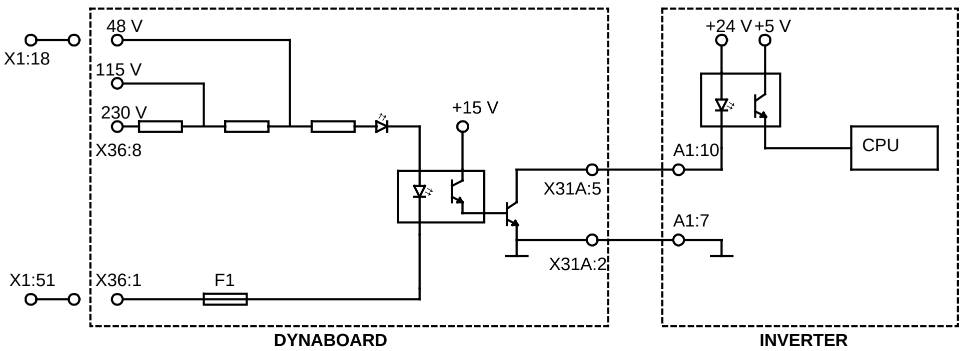
Appendix A7 Signal connections

The connections of DynAC signals are explained in the following tables.

Control voltage 48/115/230 V				Inverter			
Name	Terminal	Contact	Voltage/AC	Voltage/DC	Terminal	Name	Parameter
S1	X1:13	Open Closed	0 V 48/115/230 V	24 V 0 V	A1:8	S1 (DIA1)	
S2	X1:16	Open Closed	0 V 48/115/230 V	24 V 0 V	A1:9	S2 (DIA2)	
AP	X1:17	Open Closed	0 V 48/115/230 V	24 V 0 V	A2:10	AP (DIC12)	P3.16
CMS	X1:18	Open Closed	0 V 48/115/230 V	24 V 0 V	A2:9	CMS (DIC11)	P3.15
FWE	X1:53	Open Closed	0 V 48/115/230 V	24 V 0 V	A1:10	FWE (DIA3)	P3.1
MFI	X1:54	Open Closed	0 V 48/115/230 V	24 V 0 V	A2:11	MFI (DIC13)	P3.17
S11	X1:55	Open Closed	0 V 48/115/230 V	24 V 0 V	A2:12	S11 (DIC14)	P3.18
S21	X1:56	Open Closed	0 V 48/115/230 V	24 V 0 V	A2:13	S21 (DIC15)	P3.19
S12	X1:57	Open Closed	0 V 48/115/230 V	24 V 0 V	A1:14	S12 (DIB4)	P3.2
S22	X1:58	Open Closed	0 V 48/115/230 V	24 V 0 V	A1:15	S22 (DIB5)	P3.3
RDY	X1:26	Open Closed	0 V 48 V	24 V 0 V	A1:16	OK (DIB6)	P3.4

A simplified connection diagram of the Field Weakening Enabling (FWE) signal is presented below. The principle is the same in the other inputs. The RDY-input has some differences compared to the others.

- RDY-input via terminal X33, the others are connected to DynABoard via terminal X36.
- RDY-input has its own fuse (F2), the other inputs have a common fuse (F1).
- RDY-input has its own zero-terminal X35:3/X1:73, the others have X36:1/X1:51.



Principle connection of digital input

Relay outputs						
Control voltage 48/115/230 V			Inverter			NOTE !
Name	Terminal	Voltage/AC	Terminal	Name	Parameter	
RDY	X1:26 X1:67	48/115/230 V	A1:22 A1:23	RDY (RO1)	P4.2	Reserved for brake contactor control.
ES	X1:28 X1:66	48/115/230 V	A1:25 A1:24	ES (RO2)	P4.3	Reserved for line contactor control.
		48/115/230 V	A2:23 A2:24	(RO11)	P4.7	There is no relay output on the expander board.
RD1 RD2	X1:9 X1:49	48/115/230 V	A2:25 A2:26	READY (RO12)	P4.8	
MR1 MR2	X1:10 X1:50	48/115/230 V	A2:27 A2:28	MRO (RO13)	P4.9	There is no relay output on the expander board.

Analog inputs						
Control voltage -10-+10 V			Inverter			NOTE !
Name	Terminal	Voltage/DC	Terminal	Name	Parameter	
MS	X1:32	-10-10 V	A1:2	MS (Ain1)	P3.5	
AS	X1:35	0-10 V	A1:4	AS (Ain2)	P3.10	
		-10-10 V	A2:2	(Ain11)	P3.20	There is no analog input on the expander board.
KR	X1:36	-10-10 V	A2:4	KR (Ain12)	P3.25	There is no analog input on the expander board.

Analog outputs						
Output voltage / current 0-10 V / 4-20 mA			Inverter			NOTE !
Name	Terminal	Voltage / Current DC	Terminal	Name	Parameter	
		0-20 mA	A1:18	FRS (Aout1)	P4.4	Reserved
Aout	X1:71	0-10 V	A2:20	Aout (Aout11)	P4.10	There is no analog output on the expander board.

Appendix A8 Wiring harness connections

All DynABoard connections are made with wiring harnesses. In the case of a broken wire or connector it is recommended to install a new wiring harness. See exact type codes from the device specific parts list. The connectors and wire ends have been position marked.

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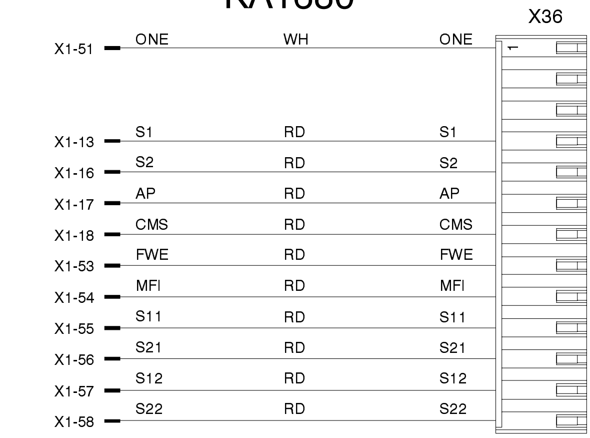

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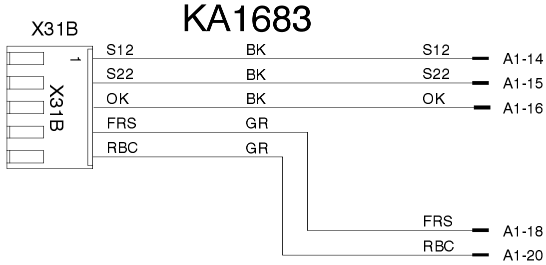

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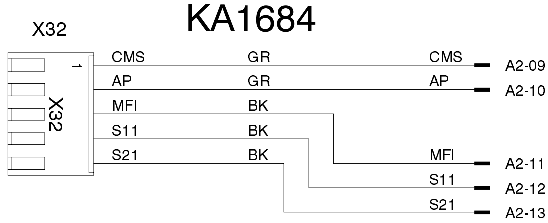

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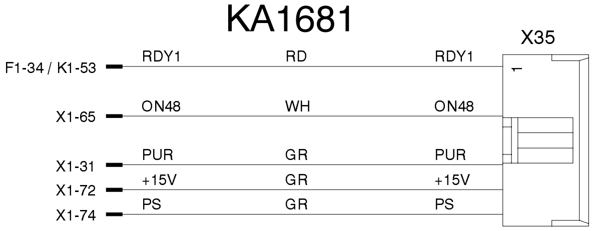

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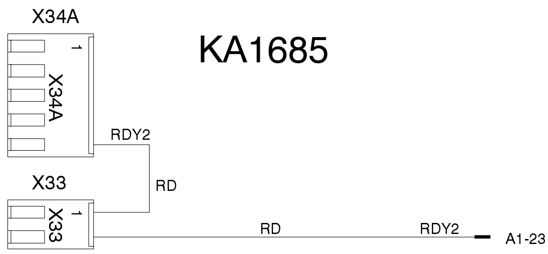

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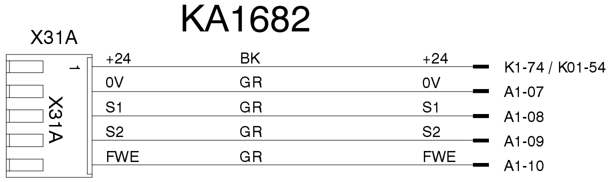


Appendix A9 Open loop V/f-adjustment

The purpose of V/f adjustment is to get optimal magnetizing current to the motor. This guarantees good low speed characteristics. Magnetizing current can be monitored from the display panel by monitoring item n3, when the motor is running without load (either no load in the hook or otherwise wheels off the rails). Adjustment can also be done theoretically, see Appendix 11.

The adjusted motor parameters are:

P6.1 Motor nominal voltage
P6.2 Motor nominal frequency
P6.3 Motor nominal speed
P6.4 Motor nominal current
P6.5 Current limit
P6.6 DC-brake current
P6.7 Maximum frequency
P6.13 Field Weakening point
P6.14 Voltage at Field Weakening point

P7.1 Zero frequency voltage
P7.2 Midpoint voltage of V/f-curve
P7.3 Midpoint frequency of V/f-curve
P7.7 Motor cos phi (cosφ)
P7.8 Stator impedance

Note!	**Note! If motor type is marked on the parameter list, this adjustment is done at the factory and there is normally no need to change them. However, in some cases the pre-adjusted parameters do not give the best result and the adjustment should be done according to this instruction.**

1. Set P6.15 equal to 0
2. Set P6.1 equal to nominal voltage of motor (from motor rating plate).
3. Set P6.2 equal to nominal frequency of motor (from motor rating plate).
4. Set P6.3 equal to nominal speed of motor (from motor rating plate).
5. Set P6.4 equal to nominal current of motor (from motor rating plate).
   - Note that if there are several motors in parallel, the correct value is the nominal current of one motor multiplied by the number of motors.
6. Set P6.5 (current limit) to 1.5 times P6.4 (nominal current).
   - Note that the value must be limited to DynAC maximum output current (1 minute value).
   - Note that if there are several motors in parallel, the number of motors has been considered in the value of P6.4.
7. Set P6.7 equal to desired maximum frequency (usually nominal frequency of motor).
8. Set P7.7 equal to cos phi (cosφ) of motor (from motor rating plate).
9. Set P7.8 equal to measured motor phase impedance.
   A. Switch power off and disconnect the motor from inverter terminals.
   B. Measure the motor stator phase impedance from disconnected cable ends.
      - Note that if there are several motors in parallel, the correct value is about the stator impedance of one motor divided by the number of motors.
      - Note that a simple multimeter might not be good enough to measure low resistances.
   C. Connect the motor and switch power on.

10. P7.1, P7.2, P7.3 and P7.8 adjustment depends on motor(s) used. The following table shows the initial values from where to start the adjustment (depending on motor frame size). The table shows also corresponding code of IEC-72 for motor frame size.

Frame	IEC-code	P7.1 (%)	P7.2 (%)	P7.3 (Hz)	P7.8 (Ω)
≤ M7	≤ 70	7.0	10.0	4.0	30.0
M9	90	5.0	7.0	3.0	10.0
M10	100	4.2	6.0	2.5	3.50
M11	112	3.5	5.0	2.0	2.50
M13	132	2.8	4.0	1.5	1.00
M16	160	2.1	3.0	1.0	0.50
M18	180	1.4	2.0	0.8	0.30
M20	200	1.0	1.5	0.6	0.20
≥ M22	≥ 225	0.7	1.0	0.4	0.10

Specially for small (up to M9) two speed motors and slow (less than 1000rpm) motors optimal P7.2 and P7.1 setting values may be up to 3 times larger than the values in the table.

If rated frequency of the motor is not between 50Hz and 60Hz, the value given in previous table for P7.3 should be multiplied by rated frequency and divided by 50.

11. Set P6.8 and P6.9 equal to P7.3.
    A. Run at maximum speed and check the motor current value (monitoring item n3).
    B. Try to run at minimum speed and check the motor current value. Motor current at minimum speed should be about average of the previously measured maximum speed current and the rated current.
    C. Increase P7.2 to increase motor current or decrease P7.2 to decrease motor current. Run again minimum speed and check motor current. Repeat step B until current value is within the desired range.
12. Set P6.8 and P6.9 equal to P7.3 divided by 2.
    A. Try to run at minimum speed and check the motor current value. It must be about average of the previously measured maximum speed current and rated current.
    B. Increase P7.1 to increase motor current or decrease P7.1 to decrease motor current. Run again minimum speed and check motor current. Repeat step A until current value is within the desired range. The motor might not run if the frequency is very low.
13. Set P6.8 and P6.9 according to desired minimum speed.
14. If the motor is not running at minimum speed, increase parameters P6.8 and P6.9 and continue from step 11.
15. When finished
    - for frequency control leave P6.15 to 0
    - for speed control set P6.15 to 1

Appendix A10 Theoretical setting of open loop parameters

This approximate method is designed for tuning motor parameters in cranes specially for other manufacturer's motors and for those cases when information about motors is not easily available. The adjusted motor parameters are:

P6.1	Motor nominal voltage
P6.2	Motor nominal frequency
P6.3	Motor nominal speed
P6.4	Motor nominal current
P6.5	Current limit
P6.6	DC-brake current
P6.7	Maximum frequency
P6.13	Field Weakening point
P6.14	Voltage at Field Weakening point
P7.1	Zero frequency voltage
P7.2	Midpoint voltage of V/f-curve
P7.3	Midpoint frequency of V/f-curve
P7.7	Motor cos phi (cosφ)
P7.8	Stator impedance

Only parameters P7.1, P7.2 and P7.3 has to be calculated, the rest of the parameters shown above can be set directly based on the measured and given information about motor (see Appendix A9 steps 1-9). An approximate tuning in a crane can be done in the following way:

Measure resistance R between phases of a cold motor (first open motor wires in DynAC).

$$R_S = 1.15 \times \frac{R}{2}$$

where R = resistance measured between phases
R_S = the stator resistance of the cold motor

The factor 1.15 means that the stator resistance of a hot motor is approximately 1.15 times the resistance of a cold motor.

Note! In Y-connection this equation gives the resistance of a coil of the stator and in Δ-connection it gives the stator resistance reduced to Y-connection.

Drive on full speed and read current (*I*) on DynAC's display.

$$I_0 = \frac{I}{n}$$

where I_0 = motor no-load current
n = number of motors

Calculating of zero frequency voltage, parameter P7.1

$$P7.1 = \frac{\sqrt{3} \times I_0 \times R_S \times 100\%}{P6.1} \approx \frac{I_0 \times R \times 100\%}{P6.1}$$

Calculating of midpoint frequency of V/f-curve, parameter P7.3

$$P7.3 = \frac{\sqrt{3} \times R_S \times P6.2 \times I_0}{P6.1} \approx \frac{R \times P6.2 \times I_0}{P6.1}$$

Calculating of midpoint voltage of V/f-curve, parameter P7.2

$$P7.2 = \frac{\sqrt{6} \times I_0 \times R_S \times 100\%}{P6.1} \approx \frac{\sqrt{2} \times I_0 \times R \times 100\%}{P6.1}$$

Appendix A11 Closed loop tuning

This instruction is valid for closed loop speed control (P6.15=3). The parameter groups 6, 7 and 8 (motor parameter set 1) are equal to parameter groups 9, 10 and 11 (motor parameter set 2). Record all values in closed loop start-up table.

Note!	**The closed loop parameters must always be set in start-up.**

Note!	**Closed loop vector control is very sensitive to encoder pulse defects. Faulty encoder connections and disturbance in encoder pulses may cause wrong operation or inverter faults, see Appendix A4 "Encoder connection".**

1. Before start-up

- verify encoder type and pulse number, check also parameter P8.1
- verify motor rating plate values, check also parameters P6.1, P6.2, P6.3 and P6.4
- check P6.6 = P6.4
- measure supply voltage, check parameter P2.3
- find out the motor no load current and set it to parameter P8.3
- set the brake opening delay P6.19 according to table

Brake type	**P6.19**
Disk brake	≤ 0.20 s
Hydraulic shoe brake	0.20 - 0.40 s

2. Encoder

- set P6.15 = 3
- reset the fault history
- drive at minimum frequency over 10 seconds
- check fault history
  - ⇒ if fault history contains any faults, act on instructions in manual section 5.1 "Inverter fault codes" and Appendix A4 section "Troubleshooting of encoder connections"
- during run, check:
  - n2 Motor speed corresponds to direction (+ to direction 1, – to direction 2)
  - n3 Motor current corresponds to no load current (P8.3), accuracy ±10%
  - n4 Motor torque is near to 0%
- if n3 and n4 values differ
  - ⇒ check encoder pulse number
  - ⇒ check parameter P8.1 corresponds encoder pulse number
  - ⇒ check the brake opens

2.1 Stopping and brake closing

- typically P6.20 = 0.0Hz, P6.21 = 0.0Hz and P8.2 = 0.50s
- check that brake closes properly

3. No load current

Use reliable no load current value. If the reliable value is not available, check current as follows:

- set maximum frequency P6.7 = P6.2–10Hz (e.g. if P6.2 = 50Hz, set P6.7 = 50Hz–10Hz = 40Hz)
- the crane should be driven without load or with very light load

1. set parameters to open loop: P6.15 = 0, P7.1 = 0%, P7.2 = 0%, P7.3 = 0Hz and P7.4 = 0

⇒ drive at maximum frequency (P6.7) and at the constant speed
- check that the rotating direction is correct
- check from monitoring item n1 that it corresponds to the maximum frequency
- check from monitoring item n6 that it corresponds to linear V/f-curve voltage
- see monitoring item n3 and record it to closed loop start-up table

⇒ set the measured current value n3 to parameter P8.3

2. set parameters back to closed loop: P6.15 = 3

⇒ drive at maximum frequency (P6.7) and at the constant speed
- check from monitoring item n1 that it corresponds to the maximum frequency
- check from monitoring item n6 that it corresponds to linear V/f-curve voltage
- see monitoring item n3 and record it to closed loop start-up table

⇒ if voltage value n6 differs from linear V/f-curve (the linear voltage value at frequency n1), adjust value of motor nominal magnetizing current parameter P8.3:
a) if voltage is lower than linear => increase value of parameter P8.3
b) if voltage is higher than linear => decrease value of parameter P8.3

4. Test drive without load

- make sure P6.7 = P6.2–10Hz (e.g. if P6.2 = 50Hz, set P6.7 = 50Hz–10Hz = 40Hz)
- make sure P6.15 = 3

⇒ drive at different speed reference values and check that motor rotates according to reference and record values of
n1 Output frequency
n3 Motor current
n4 Motor torque
n6 Motor voltage

5. Load test with load >50% (recommended 80...125%)

Make sure P6.15 = 3
If any problems during acceleration/deceleration, contact Konecranes service.

6. Closed loop parameters

Typical parameter values:

Speed controller	High speed controller	Torque controller	Magnetizing controller	Stabilator	Slip adjust (%)
P8.6 = 30...80	P8.8 = 30	P8.10 = 150	P8.15 = 150	P8.12 = 30	P8.14 = 100
P8.7 = 10	P8.9 = 10	P8.11 = 5	P8.16 = 5		

6.1 Current controllers (high speed, torque and magnetizing controllers)

Usually parameter changes are not needed (P8.8 & P8.9, P8.10 & P8.11 and P8.15 & P8.16). The torque and magnetizing controllers may have to be adjusted if motor nominal frequency is not 50 Hz or 60 Hz. The values of P8.10 and P8.11 should be same as P8.15 and P8.16.

6.2 Speed controller

The inertia effects to speed controller parameters. A high inertia requires high gain value. Low inertia requires low gain value. If gain value is too high, it may cause vibration. A permanent speed difference can be eliminated by integration. High integration time value eliminates the difference slowly. Small integration time value eliminates the difference fast, but may cause vibration.

	disk brake	shoe brake
P8.6	10...30	30...50
P8.7	5...10	5...10

7. Brake opening and closing

7.1 Brake opening and start

- typically P6.16 = 0.0Hz, P6.17 = 0.0Hz, P6.18 = 0.00s, P6.19 = 0.20s and P8.13 = 0
- set minimum frequency parameters P6.8 and P6.9 to 1.0 Hz
- start to minimum speed forward
  - ⇒ check that brake opens properly
  - ⇒ if motor generates too much torque against the brake
    - decrease start frequency P6.16 and P6.17 (if > 0.0Hz)
  - ⇒ if motor vibrates or makes unusual noise, the reason may be:
    - closed loop parameters (see section closed loop parameters)

7.2 Stopping and brake closing

- set P6.8 and P6.9 to application dependent value
- typically P6.20 = 0.0Hz, P6.21 = 0.0Hz and P8.2 = 0.50s
  - ⇒ check that brake closes properly
  - ⇒ if motor vibrates or makes unusual noise during magnetizing delay, the reason may be speed control parameters
    - decrease value of parameter P8.6

8. Troubleshooting

- ⇒ vibration at small speeds and F1 (overcurrent)
  - current gain values are too high
- ⇒ vibration at whole speed area => speed gain value is too high
- ⇒ vibrating at speed area 90 ... 100% and at deceleration from full speed
  - high speed gain value is too high
- ⇒ the motor rotating speed does not follow the reference exactly, motor current is vibrating
  - speed gain value is too low
- ⇒ generator side current limit F34 in deceleration
  - deceleration time too short, increase value of P6.11

CLOSED LOOP START-UP TABLE

DynAC rating plate	
DynAC	
Serial No	
Work No	

Project information	
Project name	
Project number	
Adjusted by	
Date	

1. Motor rating plate

Number of motors : ____________________

Motor code:			
Power:	**kW**	**ED:**	
Voltage:	**V**	**Frequency:**	**Hz**
Speed:	**rpm**	**Current:**	**A**
No-load current:		**A**	

Brake

☐ Shoe brake ☐ Disk brake

Number of brakes : ____________________

3.1. No load current with open loop control (0-mode)

Without load: P6.15 = 0, P7.1 = 0,00%, P7.2 = 0,00%, P7.3 = 0,0Hz, P7.4 = 0

n1= Hz	n3= A	n6= V

3.2. No load current with closed loop control (3-mode)

Without load: P6.15 = 3

n1= Hz	n3= A	n6= V

4. Test drive without load with closed loop (3-mode)

Without load: P6.15 = 3

n1= Hz	n3= A	n4= %	n6= V

6. Closed loop parameters

P8.3 A	P6.18 s	P8.6	P8.8	P8.10	P8.15	P8.12
P8.14 %	P6.19 s	P8.7	P8.9	P8.11	P8.16	P8.13

Remarks

Appendix A12 Parameter defaults and lock levels

Below are listed the default values for parameters in open loop and closed loop. Also are listed the lock levels for parameter P2.2. Some of the parameters have a value marked X, M or Y. The values of these parameters differ depending on motor/voltage (X), application (M) and power/voltage (Y).

2. Basic Parameters		Open loop	Closed loop	Lock
2. 1	Authorization	0	0	0
2. 2	Par Lock Code	6	6	0
2. 3	Supply Voltage	X	X	2

3. Input Signals		Open loop	Closed loop	Lock
3. 1	DIA3 Function	0	0	3
3. 2	DIB4 Function	16	16	3
3. 3	DIB5 Function	17	17	3
3. 4	DIB6 Function	18	18	3
3. 5	Ain1 Function	1	1	2
3. 6	Ain1 Range	0	0	2
3. 7	Ain1 Filter Time	0,10 s	0,10 s	3
3. 8	Ain1 Bias	300,00 %	300,00 %	1
3. 9	Ain1 Gain	-300,00 %	-300,00 %	1
3. 10	Ain2 Function	2	2	2
3. 11	Ain2 Range	0	0	2
3. 12	Ain2 Filter Time	0,10 s	0,10 s	3
3. 13	Ain2 Bias	0,00 %	0,00 %	1
3. 14	Ain2 Gain	100,00 %	100,00 %	1
3. 15	DIC11 Function	11	11	3
3. 16	DIC12 Function	10	10	3
3. 17	DIC13 Function	0	0	3
3. 18	DIC14 Function	14	14	3
3. 19	DIC15 Function	15	15	3
3. 20	Ain11 Function	0	0	2
3. 21	Ain11 Range	0	0	2
3. 22	Ain11 Filter Time	0,10 s	0,10 s	3
3. 23	Ain11 Bias	0,00 %	0,00 %	1
3. 24	Ain11 Gain	100,00 %	100,00 %	1
3. 25	Ain12 Function	0	0	2
3. 26	Ain12 Range	0	0	2
3. 27	Ain12 Filter Time	0,00 s	0,00 s	3
3. 28	Ain12 Bias	0,00 %	0,00 %	1
3. 29	Ain12 Gain	100,00 %	100,00 %	1

4. Output Signals		Open loop	Closed loop	Lock
4. 1	DO1 Function	21	21	2
4. 2	RO1 Function	17	17	3
4. 3	RO2 Function	3	3	3
4. 4	Aout1 Function	1	1	2
4. 5	Aout 1 Range	2	2	2
4. 6	Aout1 Filter Time	0,00 s	0,00 s	3
4. 7	RO11 Function	1	1	2
4. 8	RO12 Function	1	1	2
4. 9	RO13 Function	0	0	2
4. 10	Aout11 Function	0	0	2
4. 11	Aout 11 Range	0	0	2
4. 12	Aout11 Filter Time	0,05 s	0,05 s	3

5. Drive Control		Open loop	Closed loop	Lock
5. 1	Slow Speed	6 Hz	6 Hz	1
5. 2	Slow Distance	0	0	1
5. 3	End Rst Delay	1,00 s	1,00 s	3
5. 4	End Action	1	1	3
5. 5	Fan Off Delay	300 s	300 s	2
5. 6	Max ESR Freq	60 Hz	60 Hz	2
5. 7	Second Speed Lim	60 Hz	60 Hz	2
5. 8	Chg Ref at Run	0	0	2
5. 9	MS logic	0	0	2
5. 10	Multistep 2	10,0 Hz	10,0 Hz	2
5. 11	Multistep 3	25,0 Hz	25,0 Hz	2
5. 12	Multistep 4	50,0 Hz	50,0 Hz	2
5. 13	Multistep 5	50,0 Hz	50,0 Hz	2
5. 14	Multistep 6	50,0 Hz	50,0 Hz	2
5. 15	Multistep 7	50,0 Hz	50,0 Hz	2
5. 16	Multistep 8	50,0 Hz	50,0 Hz	2

6. Motor Set 1		Open loop	Closed loop	Lock
6. 1	Motor Nom Voltg	X	X	1
6. 2	Motor Nom Freq	X	X	1
6. 3	Motor Nom Speed	X	X	1
6. 4	Motor Nom Current	X	X	1
6. 5	Current Limit	X	X	1
6. 6	DC-Brake Current	X	X	1
6. 7	Max Frequency	X	X	1
6. 8	Min Freq Fwd	3,0 Hz	1,5 Hz	1
6. 9	Min Freq Rev	3,0 Hz	1,5 Hz	1
6. 10	Accel Time 1	M	M	1
6. 11	Decel Time 1	M	M	1
6. 12	Intllgnt Ramps	0	0	1
6. 13	Field Weakn Pnt	X	X	1
6. 14	Voltage at FWP	100 %	100 %	1
6. 15	Control Mode	0	3	1
6. 16	Start Freq Fwd	1,50 Hz	0,0 Hz	1
6. 17	Start Freq Rev	1,50 Hz	0,0 Hz	1
6. 18	Brake Ctrl Del	0,00 s	0,00 s	1
6. 19	Brk Opening Del	0,10 s	0,20 s	1
6. 20	Brk Lim Stp Fwd	0,6 Hz	0,0 Hz	1
6. 21	Brk Lim Stp Rev	0,6 Hz	0,0 Hz	1
6. 22	Stop Function	1	1	2
6. 23	Switching Freq	Y	Y	3
6. 24	Alt Control Mode	0	0	3
6. 25	Correction Mode	0	0	3
6. 26	Aout1 Bias	0,00 %	0,00 %	1
6. 27	Aout1 Gain	78,00 %	78,00 %	1
6. 28	Aout11 Bias	0,00 %	0,00 %	1
6. 29	Aout11 Gain	100,00 %	100,00 %	1

7. Open loop 1		Open loop	Closed loop	Lock
7. 1	Zero Freq Voltg	X	0,00 %	2
7. 2	U/f Mid Voltg	X	0,00 %	2
7. 3	U/f Mid Freq	X	0,00 %	2
7. 4	Torque Boost	1	1	3
7. 5	IRadd Motor	650	650	3
7. 6	IRadd Generator	-100	-100	3
7. 7	Motor Cos Phi	X	78	1
7. 8	Stator Impedance	X	Y	1
7. 9	Start DC-Time	0,20 s	0,20 s	1
7. 10	Stop DC-Freq	0,6 Hz	1,5 Hz	1
7. 11	Stop DC-Time	0,50 s	0,50 s	1
7. 12	Trq Stb Gain	75	75	4
7. 13	Trq Stb Damp	980	980	4
7. 14	Trq Stb Fwp	20	20	4
7. 15	Voltage Stab Gain	100	100	4
7. 16	Voltage Stab Damp	600	600	4
7. 17	Field Rev Freq	3000	3000	4

8. Closed loop 1		Open loop	Closed loop	Lock
8. 1	Encoder P/R	1000 P/R	X	1
8. 2	Magnetizing Del	0,50 s	0,50 s	1
8. 3	Motor Nom I mag	2,6 A	X	1
8. 4	Reserved	0	0	4
8. 5	Prog Slip	0	0	4
8. 6	Speed Ctrl P	30	30	2
8. 7	Speed Ctrl I	10	10	2
8. 8	Hi Speed P	30	30	2
8. 9	Hi Speed I	10	10	2
8. 10	Trq Ctrl P	150	150	4
8. 11	Trq Ctrl I	5	5	4
8. 12	Stb Gain	30	30	4
8. 13	Start Up Torque	0	0	2
8. 14	Slip Adjust	100,00 %	100,00 %	4
8. 15	Magn Ctrl P	150	150	4
8. 16	Magn Ctrl I	5	5	4
8. 17	Torque Limit	0,0 %	0,0 %	4

9. Motor Set 2		Open loop	Closed loop	Lock
9. 1	Motor Nom Voltg	X	X	1
9. 2	Motor Nom Freq	X	X	1
9. 3	Motor Nom Speed	X	X	1
9. 4	Motor Nom Current	X	X	1
9. 5	Current Limit	X	X	1
9. 6	DC-Brake Current	X	X	1
9. 7	Max Frequency	X	X	1
9. 8	Min Freq Fwd	3,0 Hz	1,5 Hz	1
9. 9	Min Freq Rev	3,0 Hz	1,5 Hz	1
9. 10	Accel Time 1	M	M	1
9. 11	Decel Time 1	M	M	1
9. 12	Intllgnt Ramps	0	0	1
9. 13	Field Weakn Pnt	X	X	1
9. 14	Voltage at FWP	100 %	100 %	1
9. 15	Control Mode	0	3	1
9. 16	Start Freq Fwd	1,50 Hz	0,0 Hz	1
9. 17	Start Freq Rev	1,50 Hz	0,0 Hz	1
9. 18	Brake Ctrl Del	0,00 s	0,00 s	1
9. 19	Brk Opening Del	0,10 s	0,20 s	1
9. 20	Brk Lim Stp Fwd	0,6 Hz	0,0 Hz	1
9. 21	Brk Lim Stp Rev	0,6 Hz	0,0 Hz	1
9. 22	Stop Function	1	1	2
9. 23	Switching Freq	Y	Y	3
9. 24	Alt Control Mode	0	0	3
9. 25	Correction Mode	0	0	3
9. 26	Aout1 Bias	0,00 %	0,00 %	1
9. 27	Aout1 Gain	78,00 %	78,00 %	1
9. 28	Aout11 Bias	0,00 %	0,00 %	1
9. 29	Aout11 Gain	100,00 %	100,00 %	1

10. Open loop 2		Open loop	Closed loop	Lock
10. 1	Zero Freq Voltg	X	0,00 %	2
10. 2	U/f Mid Voltg	X	0,00 %	2
10. 3	U/f Mid Freq	X	0,00 %	2
10. 4	Torque Boost	1	1	3
10. 5	IRadd Motor	650	650	3
10. 6	IRadd Generator	-100	-100	3
10. 7	Motor Cos Phi	X	78	1
10. 8	Stator Impedance	X	Y	1
10. 9	Start DC-Time	0,20 s	0,20 s	1
10. 10	Stop DC-Freq	0,6 Hz	1,5 Hz	1
10. 11	Stop DC-Time	0,50 s	0,50 s	1
10. 12	Trq Stb Gain	75	75	4
10. 13	Trq Stb Damp	980	980	4
10. 14	Trq Stb Fwp	20	20	4
10. 15	Voltage Stab Gain	100	100	4
10. 16	Voltage Stab Damp	600	600	4
10. 17	Field Rev Freq	3000	3000	4

11. Closed loop 2		Open loop	Closed loop	Lock
11. 1	Encoder P/R	1000 P/R	X	1
11. 2	Magnetizing Del	0,50 s	0,50 s	1
11. 3	Motor Nom I mag	2,6 A	X	1
11. 4	Reserved	0	0	4
11. 5	Prog Slip	0	0	4
11. 6	Speed Ctrl P	30	30	2
11. 7	Speed Ctrl I	10	10	2
11. 8	Hi Speed P	30	30	2
11. 9	Hi Speed I	10	10	2
11. 10	Trq Ctrl P	150	150	4
11. 11	Trq Ctrl I	5	5	4
11. 12	Stb Gain	30	30	4
11. 13	Start Up Torque	0	0	2
11. 14	Slip Adjust	100,00 %	100,00 %	4
11. 15	Magn Ctrl P	150	150	4
11. 16	Magn Ctrl I	5	5	4
11. 17	Torque Limit	0,0 %	0,0 %	4

12. Intelligent Ramps		Open loop	Closed loop	Lock
12. 1	Ramp 1 Shape	0,0 s	0,0 s	2
12. 2	Ramp 2 Shape	0,0 s	0,0 s	2
12. 3	Accel Time 2	5,0 s	5,0 s	1
12. 4	Decel Time 2	5,0 s	5,0 s	1
12. 5	Ramp Lim f1	12,5 Hz	12,5 Hz	2
12. 6	Ramp Lim f2	25,0 Hz	25,0 Hz	2
12. 7	Acc 1 Fwd	12,0 s	12,0 s	2
12. 8	Acc 2 Fwd	8,0 s	8,0 s	2
12. 9	Acc 3 Fwd	6,0 s	6,0 s	2
12. 10	Acc 3 Fwd FWE	6,0 s	6,0 s	2
12. 11	Dec 1 Fwd	12,0 s	12,0 s	2
12. 12	Dec 2 Fwd	8,0 s	8,0 s	2
12. 13	Dec 3 Fwd	6,0 s	6,0 s	2
12. 14	Dec 3 Fwd FWE	6,0 s	6,0 s	2
12. 15	Dir Chg Fwd	8,0 s	8,0 s	2
12. 16	Stop Ramp Fwd	8,0 s	8,0 s	2
12. 17	Acc 1 Rev	12,0 s	12,0 s	2
12. 18	Acc 2 Rev	8,0 s	8,0 s	2
12. 19	Acc 3 Rev	6,0 s	6,0 s	2
12. 20	Acc 3 Rev FWE	6,0 s	6,0 s	2
12. 21	Dec 1 Rev	12,0 s	12,0 s	2
12. 22	Dec 2 Rev	8,0 s	8,0 s	2
12. 23	Dec 3 Rev	6,0 s	6,0 s	2
12. 24	Dec 3 Rev FWE	6,0 s	6,0 s	2
12. 25	Dir Chg Rev	8,0 s	8,0 s	2
12. 26	Stop Ramp Rev	8,0 s	8,0 s	2

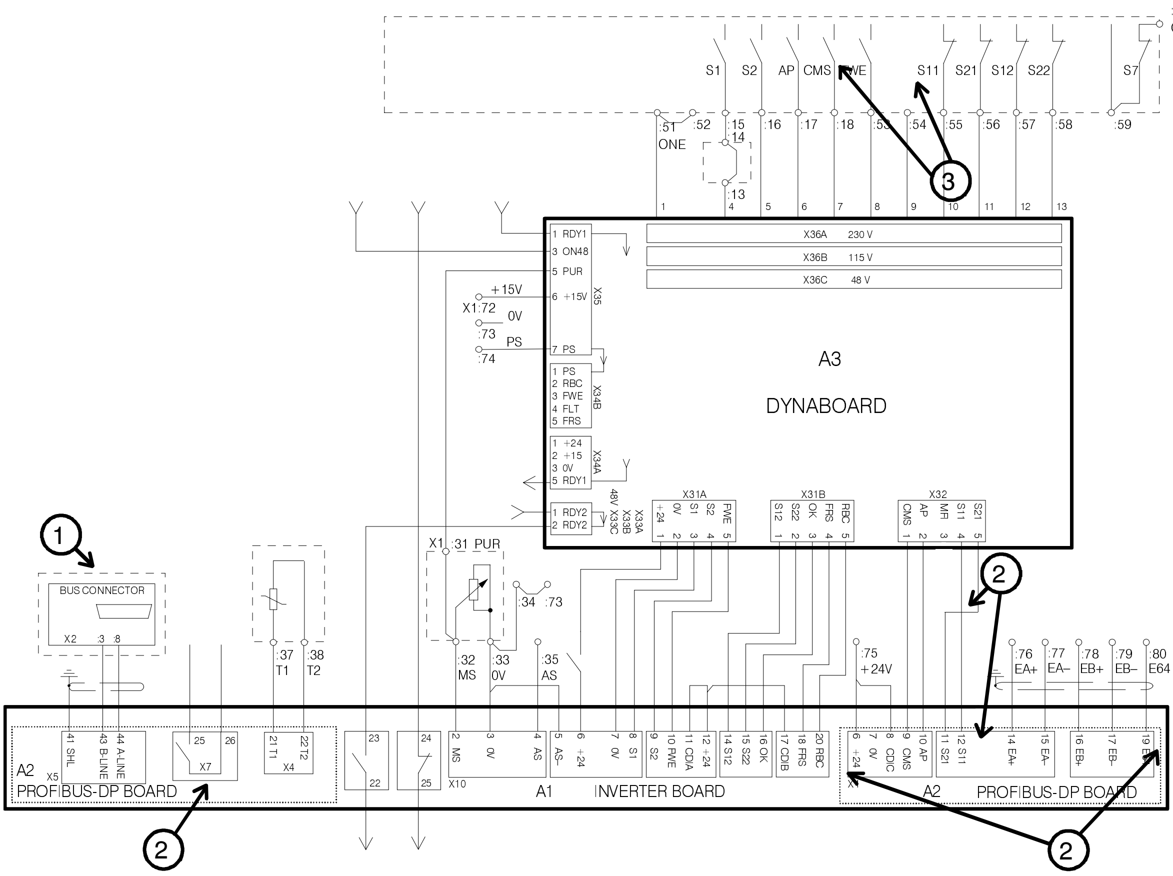
13. Profibus Diagnostic Paramet		Open loop	Closed loop	Lock
13. 1	Slave Address	X	X	4
13. 2	Baud Rate	4	4	4
13. 3	PPO-Type	2	2	4
13. 4	Actual Value	11	11	3
13. 5	Process Data 1	2	2	2
13. 6	Process Data 2	3	3	2
13. 7	Process Data 3	4	4	2
13. 8	Process Data 4	5	5	2

14. Profibus PB CTRL		Open loop	Closed loop	Lock
14. 1	Bus Control	0	0	4
14. 2	DIA1 Source	0	0	4
14. 3	DIA2 Source	0	0	4
14. 4	DIA3 Source	0	0	4
14. 5	DIB4 Source	0	0	4
14. 6	DIB5 Source	0	0	4
14. 7	DIB6 Source	0	0	4
14. 8	DIC12 Source	0	0	4
14. 9	DIC13 Source	0	0	4
14. 10	DIC14 Source	0	0	4
14. 11	Bus Fault Delay	0,0 s	0,0 s	4

15. Protections		Open loop	Closed loop	Lock
15. 1	Motor Thermistor	0	0	3
15. 2	Ref Fault Resp	0	0	3
15. 3	Brake Chopper	1	1	4
15. 4	Line Supervision	2	2	4
15. 5	Output Supervision	X	X	4
15. 6	Earth Fault	2	2	4
15. 7	Prohib Freq Low1	0,0 Hz	0,0 Hz	3
15. 8	Prohib Freq High1	0,0 Hz	0,0 Hz	3
15. 9	Prohib Freq Low2	0,0 Hz	0,0 Hz	3
15. 10	Prohib Freq High2	0,0 Hz	0,0 Hz	3
15. 11	OvercurrM P Mul	1000	1000	4
15. 12	OvercurrM I Mul	-750	-750	4

16. Laboratory 2		Open loop	Closed loop	Lock
16. 1	DA 1 Address	16384	16384	4
16. 2	DA 1 Mask	-1	-1	4
16. 3	DA 1 Multiply	1	1	4
16. 4	DA 2 Address	16384	16384	4
16. 5	DA 2 Mask	-1	-1	4
16. 6	DA 2 Multiply	1	1	4
16. 7	DA 3 Address	16384	16384	4
16. 8	DA 3 Mask	-1	-1	4
16. 9	DA 3 Multiply	1	1	4

Appendix A13 Specialities of profibus models



1. Profibus-terminal.

2. Input and output signals in different expansion boards

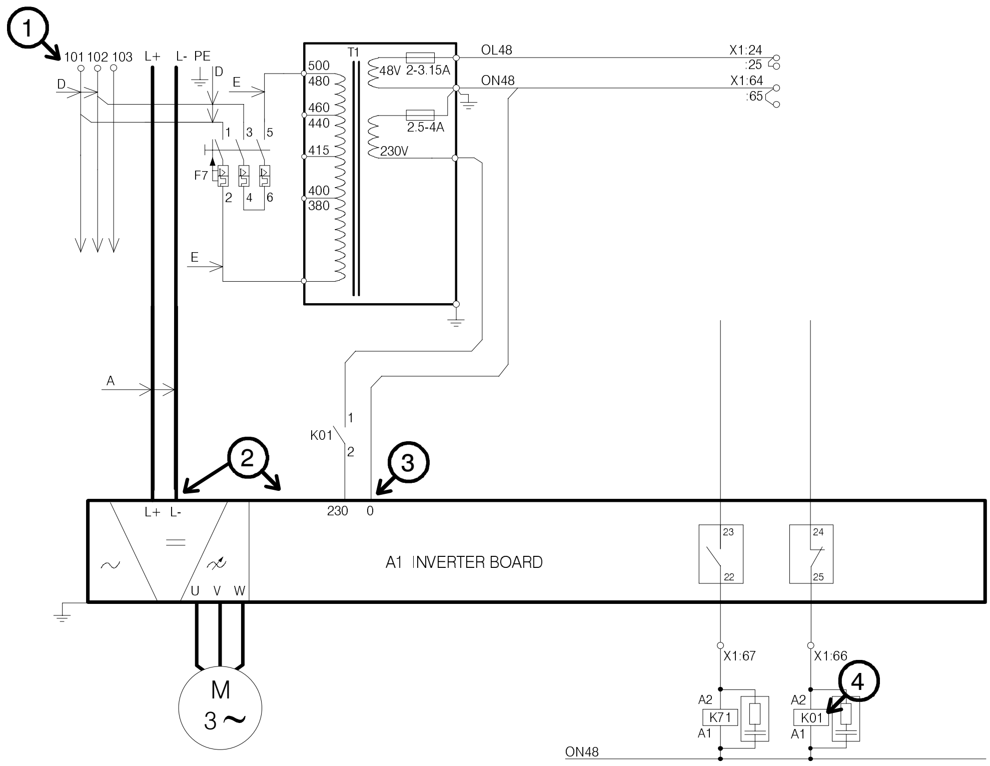
Board	DIC11	DIC12	DIC13	DIC14	DIC15	RO11	RO12	RO13	Ain11	Ain12	Aout11
Encoder board	CMS	AP	MFI	S11	S21	NOT USED	READY	MRO	NOT USED	KR	Aout
Expander board	CMS	AP	MFI	S11	S21	—	READY	—	—	—	—
Profibus board	CMS*)	AP	S21	S11	—	—	READY	—	—	—	—

3. Digital input signals in profibus bus control

Name	DynAC	Name	DAV	Name	Action / Parameter
S1	X1: 15	S1	A1: 8	DIA1	S1 direction command
S2	X1: 16	S2	A1: 9	DIA2	S2 direction command
FWE	X1: 53	FWE	A1: 10	DIA3	P3.1 DIA3 function
S12	X1: 57	S12	A1: 14	DIB4	P3.2 DIB4 function
S22	X1: 58	S22	A1: 15	DIB5	P3.3 DIB5 function
RDY	X1: 26	OK	A1: 16	DIB6	P3.4 DIB6 function
CMS	X1: 18	CMS	A2: 9	DIC11	CMS / Virtual input *)
AP	X1: 17	AP	A2: 10	DIC12	P3.16 DIC12 function
S21	X1: 56	S21	A2: 11	DIC13	P3.17 DIC13 function
S11	X1: 55	S11	A2: 12	DIC14	P3.18 DIC14 function
–	–	–	–	DIC15	Virtual input **)

*) When bus control is used CMS-input is reserved for selection of bus control. CMS-input signal can be used as CMS with profibus condition monitoring. Virtual input signal can be used with bus control.
**) MFI-input is not used in profibus models. Virtual input signal can be used with bus control.

Appendix A14 Specialities of "No braking" models



1. Separate power supply for control voltage transformer and shoe brake control. Shoe brake in models 55F-800F, 30K-630K.
2. Inverter power supply and electrical braking through DC-bus.
3. Supply for inverter cooling fans in models 55F-800F, 90K-630K
4. There is no line contactor in a single unit. Common line contactor with separate network braking unit DynAReg Vector.

Following parameters differ from resistor braking models:

Parameter	Name	Value	Resistor braking default
P15.3	Brake Chopper	0 = No	default 1 Yes, internal
P15.4	Line Supervision	0 = No	default 2 Fault

Appendix A15 Alterations

DynAC rev 4.2

DynAC Vector Owner's Manual rev 4.0 (HU4.07.0057) was released.
There was a remarkable re-organizing of parameters from software version SM25.08 to version SM43.02, also many parameters were added and removed. The description of parameters in DynAC Vector Owner's Manual rev 4.0 can not be used for the previous SM25.0x software versions.

Control board type changed to CB00081.

Wiring of analog input AS was changed.

DynAC rev 4.3

Control board type changed from CB00081 (2MB memory) to DAV-B062 (4MB memory).
Software changed from SM43.09 to SM56.00.

Type of RC-filters was changed.

DynAC rev 4.4

DynAC Vector Service Manual rev 4.1 (HU4.07.0062) was released.
There was a remarkable re-organizing of parameters from software version SM56.04 to version SM80.01 and also many parameters were added and removed. The description of parameters in DynAC Vector Service Manual rev 4.1 can not be used for the earlier software versions SM25.0x, SM43.0x and SM56.0x. For description of these previous software versions, see DynAC Vector Owner's Manual rev 4.0.

New power classes and voltage series added.

DynAC rev 4.5

DynAC Vector Service Manual rev 4.2 (HU4.07.0062 issue A) was released. Replaces the previous manual DynAC Vector Service Manual rev 4.1.
Some parameter changes from software version SM80.02 to version SM80.03

- P8.4/P11.4 “Pos Ctrl Limit” replaced by “Reserved”
- P8.5/P11.5 “Pos Ctrl I Time” replaced by “Prog Slip”
- P8.14/P11.14 “Nom Flux Curr” replaced by “Slip Adjust”
- Profibus control parameters added to group 14
- Lock levels changed

Profibus and No braking models added.

Appendix A16 Replacing old DynAC versions

DynAC Vector can be used to replace the old DynAC versions by following limitations:

DynAC rev 1

Terminals can be crossconnected to DynAC Vector without any external components.
– Separate wiring instructions for crossconnection are available.
Replacing DynAC 0.75H-15H can usually be done by some changes to assembly plate in cubicle, otherwise a new cubicle is required.

DynAC rev 2

Terminals can be crossconnected to DynAC Vector without any external components.
– Separate wiring instructions for crossconnection are available.
Replacing DynAC 7.5H may in some cases require a new cubicle.
Replacing DynAC 110H-160H requires a new cubicle.

DynAC rev 3

Terminals can be crossconnected to DynAC Vector without any external components.
– Separate wiring instructions for crossconnection are available.
Replacing DynAC 7.5H may in some cases require a new cubicle.
Replacing DynAC 110H-160H requires a new cubicle.

Appendix A17 Spare Parts lists

Spare parts for J-series

Item	Device	Mat.no	Type	2.2 J	3.0 J	4.0 J	5.5 J	7.5 J	11 J	15 J	18.5 J	22 J	30 J	37 J	45 J
A1	Inverter **NOTE !** Type code details marked with "_" define unit options. Specify these options according to parts list. The first option mark specifies the type of display panel (L/G) and the second specifies the type of expansion board (P/N/U).		DAV xxxx NJ_1N1_1 "xxxx" defines inverter power class 0022 equals 2.2J 0450 equals 45J	1	1	1	1	1	1	1	1	1	1	1	1
at A1	7-Segment LED panel (L)	450130	DAV-1L	1	1	1	1	1	1	1	1	1	1	1	1
at A1	Graphic LCD panel (G)	450131	DAV-1G	1	1	1	1	1	1	1	1	1	1	1	1
A2	Expander Board (P)	450132	DAV-B1P	1	1	1	1	1	1	1	1	1	1	1	1
A2	Encoder Board (N)	450133	DAV-B1N	1	1	1	1	1	1	1	1	1	1	1	1
at A1	Display cable (3m)	450135	DAV-RSC3	1	1	1	1	1	1	1	1	1	1	1	1
A3	I/O-Board		DynABoard KAE250	1	1	1	1	1	1	1	1	1	1	1	1
T1	Transformer	450158	200-230V/48V -135VA	1	1	1	1	1	1	1	1	1	1	1	1
T2		450159	200-230V/230V-250VA										1	1	1
at T1	Fuse (48V)	450231	5x20 T3,15A	1	1	1	1	1	1	1	1	1	1	1	1
at T2	Fuse (230V)	450228	5x20 T1,6A										1	1	1
at A3	Fuse (F1 and F2)	450227	5x20 F500mA	2	2	2	2	2	2	2	2	2	2	2	2
F7	Protective switch	243782	GV2-M08	1	1	1	1	1	1	1	1	1	1	1	1
K1	Line contactor	259699	LC1-D0910E7	1	1	1									
K1		257522	LC1-D3201E7				1	1							
K1		257524	LC1-D5011E7						1	1	1				
K1		257526	LC1-D8011E7									1			
K1		450166	LC1-D11511M7										1	1	1
K7	Contactor	259699	LC1-D0910E7	1	1	1	1	1	1	1	1	1	1	1	1
K01		259699	LC1-D0910E7										1	1	1
at K1	Auxiliary contact	256624	LA1-DN40	1	1	1	1	1	1	1	1	1			
at K1	RC-filter	251070	MKT75/0,25+220						1	1	1	1	2	2	2
at K1		450146	LA4-DA1E 24/48V	1	1	1	1	1							
at K01		450146	LA4-DA1E 24/48V										1	1	1
at K7		450146	LA4-DA1E 24/48V	1	1	1	1	1	1	1	1	1	1	1	1
R1 *	Braking resistor	256966	GRF20/267 200W 56R	2	3										
R1 *		450164	1500W-8R			1	1	1	1	1	2	2			

* = Not included in A-models

Spare parts for F-series

Item	Device	Mat.no	Type	2.2 F	2.0 F	4.0 F	5.5 F	7.5 F	11 F	15 F	18.5 F	22 F	30 F	37 F	45 F	55 F	75 F	90 F	110 F	132 F	160 F	200 F	250 F	315 F	400 F	500 F	630 F	800 F
A1	Inverter		DAV xxxx NF_1N1_1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1										
	NOTE ! Type code details marked with "_" define unit options. Specify these options according to parts list. The first option mark specifies the type of display panel (L/G) and the second specifies the type of expansion board (P/N/U).		DAV xxxx NF_0N1_1 "xxxx" defines inverter power class 0022 equals 2.2F 8000 equals 800F																1	1	1	1	1	1	1	1	1	1
at A1	7-Segment LED panel (L)	450130	DAV-1L	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
at A1	Graphic LCD panel (G)	450131	DAV-1G	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
A2	Expander Board (P)	450132	DAV-B1P	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1										
A2	Encoder Board (N)	450133	DAV-B1N	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
A2	Profibus DP Board (U)	450172	DAV-B1U	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
at A1	Display cable (3m)	450135	DAV-RSC3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
A3	I/O-Board		DynABoard KAE250	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
T1	Transformer	450121	500-460-415-400V / 48V - 62VA	1	1	1	1	1	1	1																		
T1		450122	500-460-415-400V / 48V - 135VA								1	1	1	1	1													
T1		450124	500-460-415-400 / 277-230 / 48V - 600VA													1	1	1	1	1	1	1	1	1	1	1	1	1
T2		450124	500-460-415-400 / 277-230 / 48V - 600VA																						1			
T11		450124	500-460-415-400 / 277-230 / 48V - 600VA																							1	1	1
at T1	Fuse (48V)	450228	5x20 T1,6A	1	1	1	1	1	1	1																		
at T1	Fuse (48V)	450231	5x20 T3,15A								1	1	1	1	1													
at T1	Fuse (48V)	450229	5x20 T2,0A													1	1	1	1	1	1	1	1	1	1	1	1	1
at T1	Fuse (230V)	450230	5x20 T2,5A													1	1	1	1	1	1	1	1	1	1	1	1	1
at T2	Fuse (48V)	450229	5x20 T2,0A																						1			
at T2	Fuse (230V)	450230	5x20 T2,5A																						1			
at T11	Fuse (48V)	450229	5x20 T2,0A																							1	1	1
at T11	Fuse (230V)	450230	5x20 T2,5A																							1	1	1
at A3	Fuse (F1 and F2)	450227	5x20 F500mA	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
F7	Protective switch	243782	GV2-M08	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
F17		243782	GV2-M08																							1	1	1
F71		243782	GV2-M08													1	1	1	1	1	1	1	1	1	1	1	1	1
K1	Line contactor	259699	LC1-D0910E7	1	1	1	1	1																				
K1		257522	LC1-D3201E7						1	1																		
K1		257524	LC1-D5011E7								1	1	1															
K1		257526	LC1-D8011E7											1	1													
K1		450166	LC1-D11511M7													1	1	1	1									
K1		256802	LC1-F265																	1	1							
K1		256803	LC1-F400																			1	1			1		
K1		450168	LC1-F500																					1			1	1
K1		450169	LC1-F630																						1			
K11		256803	LC1-F400																							1		
K11		450168	LC1-F500																								1	1
at K1	Contactor coil	256797	LX1-FH220V50Hz/60Hz																	1	1							
at K1		256796	LX1-FJ220 220V50Hz/60Hz																			1	1			1		
at K1		450170	LX1-FK220 220V50Hz/60Hz																					1			1	1
at K1		450171	LX1-FL220 220V50Hz/60Hz																						1			
at K11		256796	LX1-FJ220 220V50Hz/60Hz																							1		
at K11		450170	LX1-FK220 220V50Hz/60Hz																								1	1
K7	Contactor	259699	LC1-D0910E7	1	1	1	1	1	1	1	1	1	1	1	1													
K71		259699	LC1-D0910E7													1	1	1	1	1	1	1	1	1	1	1	1	1
K01		259699	LC1-D0910E7													1	1	1	1	1	1	1	1	1	1	1	1	1
at K1	Auxiliary contact	256624	LA1-DN40	1	1	1	1	1	1	1	1	1	1	1	1													
at K1		251410	LA1-DN20																							1	1	1
at K11		251410	LA1-DN20																							1	1	1
at K01		251410	LA1-DN20																							1	1	1
at K71		251411	LA1-DN04													1	1	1	1	1	1	1	1	1	1	1	1	1
at K71		258765	LA8-DN20													1	1	1	1	1	1	1	1	1	1	1	1	1
at F71		263135	GV2-AN20													1	1	1	1	1	1	1	1	1	1	1	1	1
at K1	RC-filter	251070	MKT75/0,25+220								1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2
at K1		450146	LA4-DA1E 24/48V	1	1	1	1	1	1	1																		
at K11		251070	MKT75/0,25+220																							2	2	2
at K7		450146	LA4-DA1E 24/48V	1	1	1	1	1	1	1	1	1	1	1	1													
at K71		450146	LA4-DA1E 24/48V													1	1	1	1	1	1	1	1	1	1	1	1	1
at K01		450146	LA4-DA1E 24/48V													1	1	1	1	1	1	1	1	1	1	1	1	1
R1 *	Braking resistor	256967	GRF20/267 200W 180R	2	2	3	3																					
R1 *		261571	1500W-22R					1	1	1																		
R1 *		261572	1500W-15R								2	2	2															

* = Not included in A-models

Spare parts for K-series

Item	Device	Mat.no	Type	2.2 K	3.0 K	4.0 K	5.5 K	7.5 K	11 K	15 K	18.5 K	22 K	30 K	37 K	45 K	55 K	75 K	90 K	110 K	132 K	160 K	200 K	250 K	315 K	400 K	500 K	630 K
A1	Inverter		DAV xxxx NK_1N1_1	1	1	1	1	1	1	1	1	1	1	1	1	1	1										
			DAV xxxx NK_0N1_1															1	1	1	1	1	1	1	1	1	1
	NOTE ! Type code details marked with "_" define unit options. Specify these options according to parts list. The first option mark specifies the type of display panel (L/G) and the second specifies the type of expansion board (P/N/U).		"xxxx" defines inverter power class 0022 equals 2.2K 6300 equals 630K																								
at A1	7-Segment LED panel (L)	450130	DAV-1L	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
at A1	Graphic LCD panel (G)	450131	DAV-1G	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
A2	Expander Board (P)	450132	DAV-B1P	1	1	1	1	1	1	1	1	1	1	1	1	1	1										
A2	Encoder Board (N)	450133	DAV-B1N	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
A2	Profibus DP Board (U)	450172	DAV-B1U	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
at A1	Display cable (3m)	450135	DAV-RSC3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
A3	I/O-Board		DynABoard KAE250	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
T1	Transformer	450160	525-575-660V / 48V - 135VA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
T2		450161	525-575-660V / 230V - 250VA															1	1	1	1	1					
T2		450162	525-575-660V / 230V - 600VA																				1	1	1	1	1
T11		450162	525-575-660V / 230V - 600VA																						1	1	1
at T1	Fuse (48V)	450231	5x20 T3,15A	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
at T2	Fuse (230V)	450228	5x20 T1,6A															1	1	1	1	1					
at T2	Fuse (230V)	450230	5x20 T2,5A																				1	1	1	1	1
at T11	Fuse (230V)	450230	5x20 T2,5A																						1	1	1
at A3	Fuse (F1 and F2)	450227	5x20 F500mA	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
F7	Protective switch	243782	GV2-M08	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
F17		243782	GV2-M08																						1	1	1
F71		243782	GV2-M08										1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
K1	Line contactor	259699	LC1-D0910E7	1	1	1	1	1	1	1																	
K1		257522	LC1-D3201E7								1	1															
K1		257524	LC1-D5011E7										1	1	1	1											
K1		257526	LC1-D8011E7														1										
K1		450166	LC1-D11511M7															1	1	1	1	1			1		
K1		256802	LC1-F265																				1	1		1	1
K11		450166	LC1-D11511M7																						1		
K11		256802	LC1-F265																							1	1
at K1	Contactor coil	256797	LX1-FH220V50Hz/60Hz																				1	1		1	1
at K11		256797	LX1-FH220V50Hz/60Hz																							1	1
K7	Contactor	259699	LC1-D0910E7	1	1	1	1	1	1	1	1	1															
K71		259699	LC1-D0910E7										1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
K01		259699	LC1-D0910E7															1	1	1	1	1	1	1	1	1	1
at K1	Auxiliary contact	256624	LA1-DN40	1	1	1	1	1	1	1	1	1	1	1	1	1	1										
at K1		251410	LA1-DN20																						1	1	1
at K11		251410	LA1-DN20																						1	1	1
at K01		251410	LA1-DN20																						1	1	1
at K71		251411	LA1-DN04										1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
at K71		258765	LA8-DN20										1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
at F71		263135	GV2-AN20										1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
at K1	RC-filter	251070	MKT75/0,25+220										1	1	1	1	1	2	2	2	2	2	2	2	2	2	2
at K1		450146	LA4-DA1E 24/48V	1	1	1	1	1	1	1	1	1															
at K11		251070	MKT75/0,25+220																						2	2	2
at K7		450146	LA4-DA1E 24/48V	1	1	1	1	1	1	1	1	1															
at K71		450146	LA4-DA1E 24/48V										1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
at K01		450146	LA4-DA1E 24/48V															1	1	1	1	1	1	1	1	1	1
R1 *	Braking resistor	256967	GRF20/267 200W 180R	2	3	3	3	4																			
R1 *		450165	1500W-75R						1	1	2	2															

* = Not included in A-models

Appendix A18 Layouts, dimensions and weights

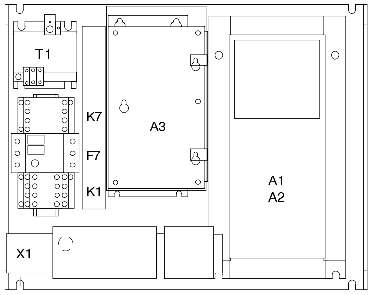
J-series

DynAC V 2.2-3.0 J-B-x-x-0-0

Dimensions WxHxD
450x358x213.5 mm

Weight (approx.)
2.2 J-B 17.5kg
3.0 J-B 17.5kg

Through-wall construction

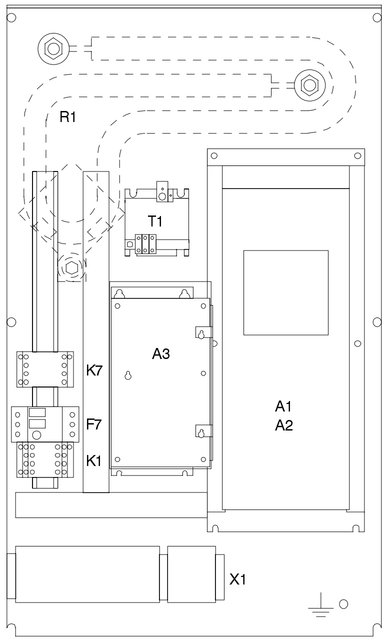


DynAC V 4.0-7.5 J-B-x-x-0-0

Dimensions WxHxD
467.5x786x238 mm

Weight (approx.)
4.0 J-B 29kg
5.5 J-B 30kg
7.5 J-B 30kg

Through-wall construction

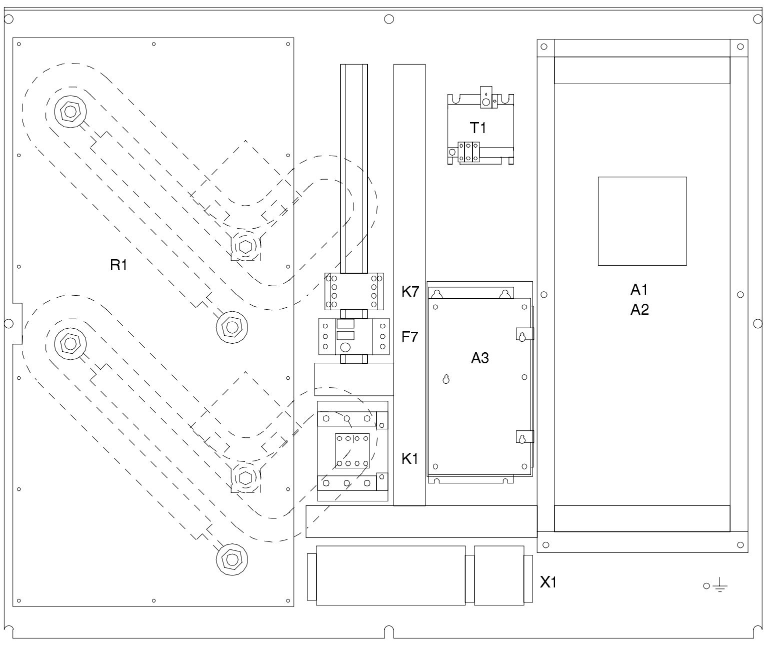


DynAC V 11-22 J-B-x-x-0-0

Dimensions WxHxD
940x786x290 mm

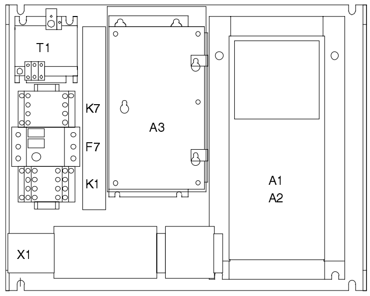
Weight (approx.)
11 J-B 60kg
15 J-B 60kg
18.5 J-B 62kg
22 J-B 62kg

Through-wall construction



J-series

DynAC V 2.2-3.0 J-A-x-x-0-0



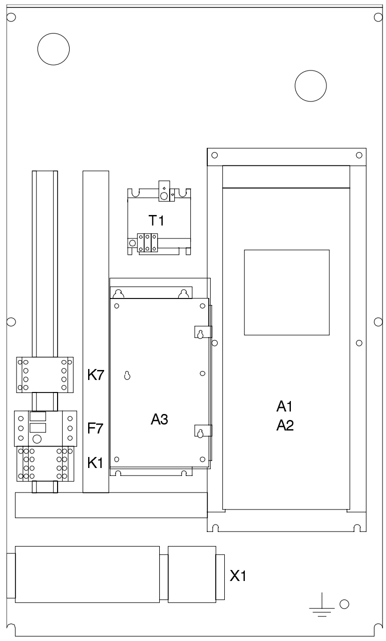
Dimensions WxHxD
450x358x213.5 mm

Weight (approx.)
2.2 J-A 16.5kg
3.0 J-A 16.5kg

Through-wall construction

Requires external resistors

DynAC V 4.0-7.5 J-A-x-x-0-0



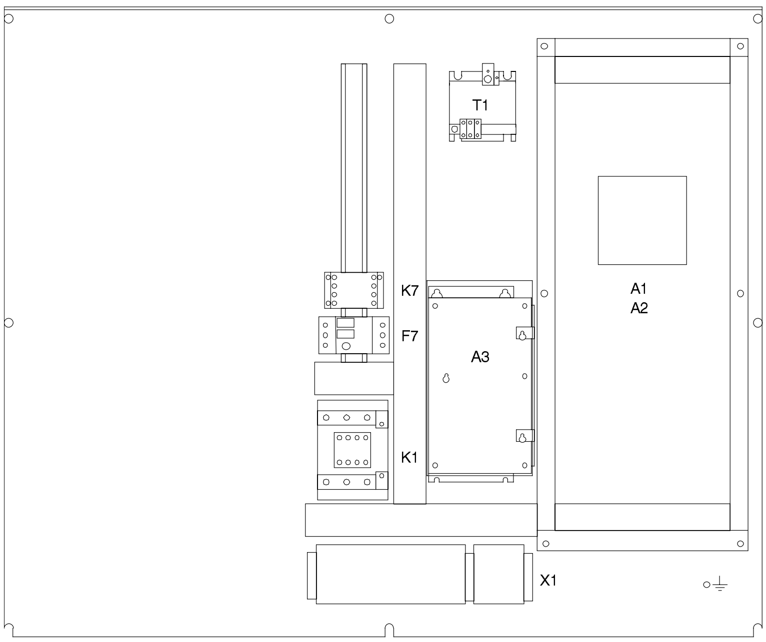
Dimensions WxHxD
467.5x786x238 mm

Weight (approx.)
4.0 J-A 28kg
5.5 J-A 28kg
7.5 J-A 29kg

Through-wall construction

Requires external resistors

DynAC V 11-22 J-A-x-x-0-0



Dimensions WxHxD
940x786x290 mm

Weight (approx.)
11 J-A 59kg
15 J-A 59kg
18.5 J-A 59kg
22 J-A 59kg

Through-wall construction

Requires external resistors

J-series

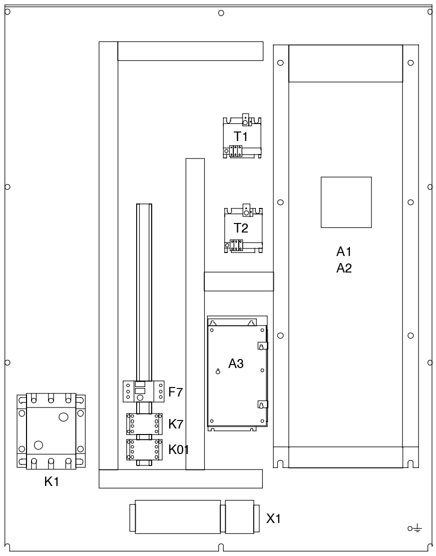
DynAC V 30-45 J-A-x-x-0-0

Dimensions WxHxD
940x1187x315 mm

Weight (approx.)
30 J-A 119kg
37 J-A 121kg
45 J-A 121kg

Through-wall construction

Requires external resistors



F-series

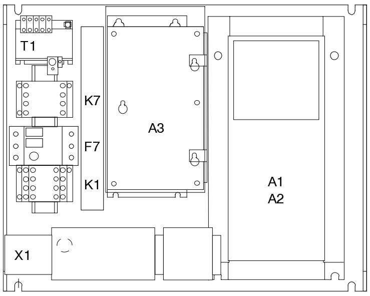
DynAC V 2.2-5.5 F-B-x-x-0-0

Dimensions WxHxD
450x358x213.5 mm

Weight (approx.)

2.2 F-B	17kg	4.0 F-B	17.5kg
3.0 F-B	17kg	5.5 F-B	17.5kg

Through-wall construction

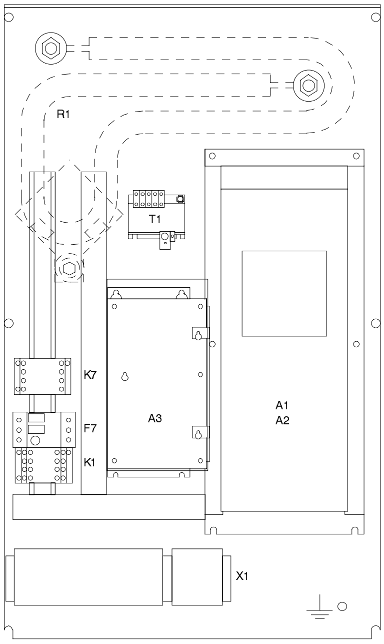


DynAC V 7.5-15 F-B-x-x-0-0

Dimensions WxHxD
467.5x786x238 mm

Weight (approx.)
7.5 F-B 29kg
11 F-B 30kg
15 F-B 30kg

Through-wall construction

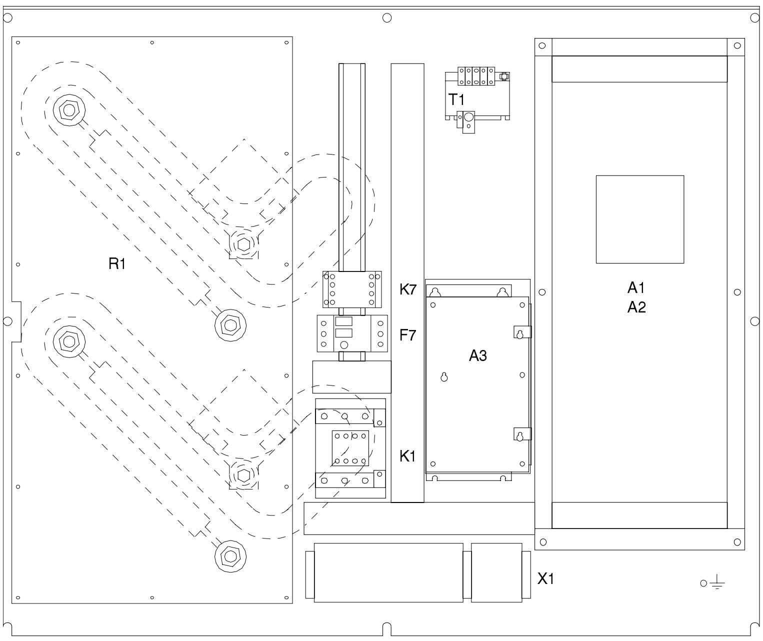


DynAC V 18.5-30 F-B-x-x-0-0

Dimensions WxHxD
940x786x290 mm

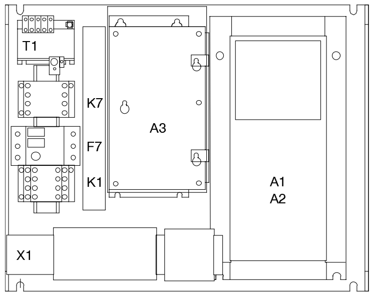
Weight (approx.)
18.5F-B 54kg
22F-B 54kg
30F-B 62kg

Through-wall construction



F-series

DynAC V 2.2-5.5 F-A-x-x-0-0



Dimensions WxHxD
450x358x213.5 mm

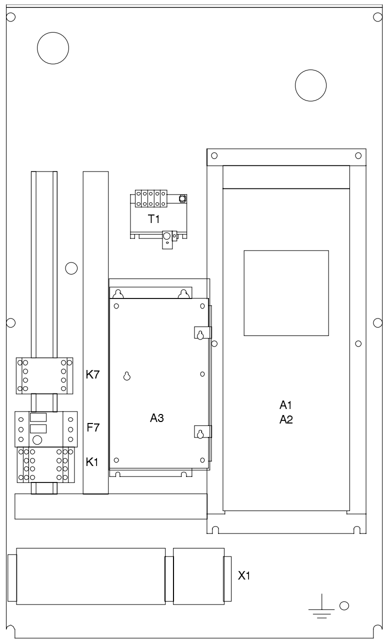
Weight (approx.)

2.2 F-A	15.5kg	4.0 F-A	16kg
3.0 F-A	15.5kg	5.5 F-A	16kg

Through-wall construction

Requires external resistors

DynAC V 7.5-15 F-A-x-x-0-0



Dimensions WxHxD
467x786x238 mm

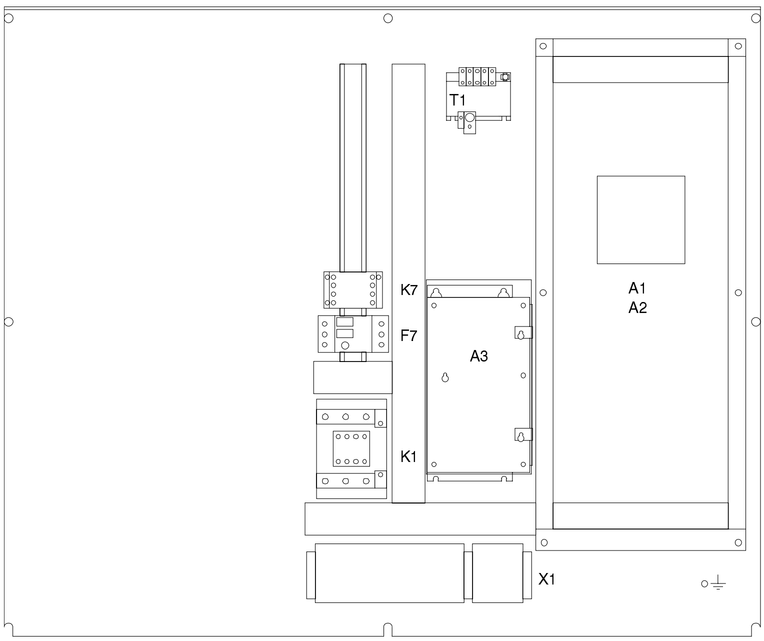
Weight (approx.)

7.5 F-A	28kg
11 F-A	29kg
15 F-A	29kg

Through-wall construction

Requires external resistors

DynAC V 18.5-45 F-A-x-x-0-0



Dimensions WxHxD
940x786x290 mm

Weight (approx.)

18.5F-A	51kg
22F-A	51kg
30F-A	59kg
37F-A	60kg
45F-A	60kg

Through-wall construction

Requires external resistors

F-series

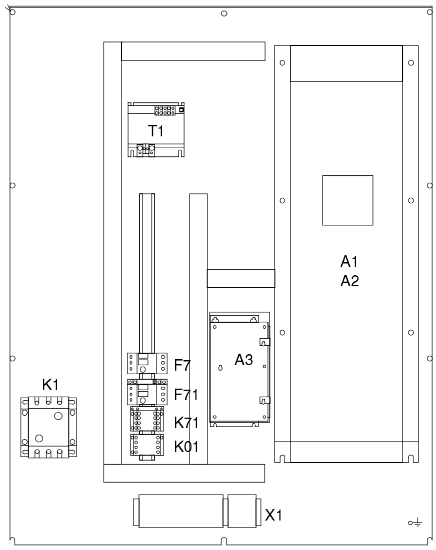
DynAC V 55-90 F-A-x-x-0-0

Dimensions WxHxD
940x1187x315 mm

Weight (approx.)
55F-A 119kg
75F-A 121kg
90F-A 121kg

Through-wall construction

Requires external resistors

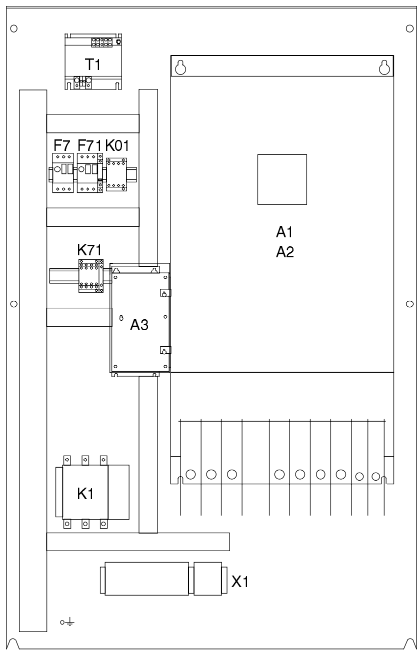


DynAC V 110-160 F-A-x-x-0-0

Dimensions WxHxD
910x1435x385 mm

Weight (approx.)
110F-A 215kg
132F-A 223kg
160F-A 225kg

Requires external resistors



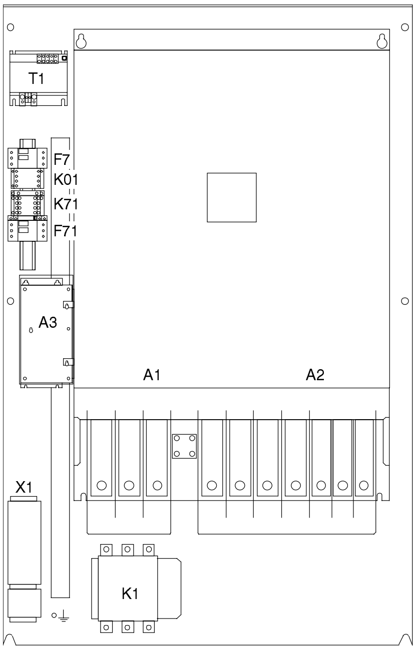
F-series

DynAC V 200-250 F-A-x-x-0-0

Dimensions WxHxD
910x1435x422 mm

Weight (approx.)
200F-A 290kg
250F-A 300kg

Requires external resistors

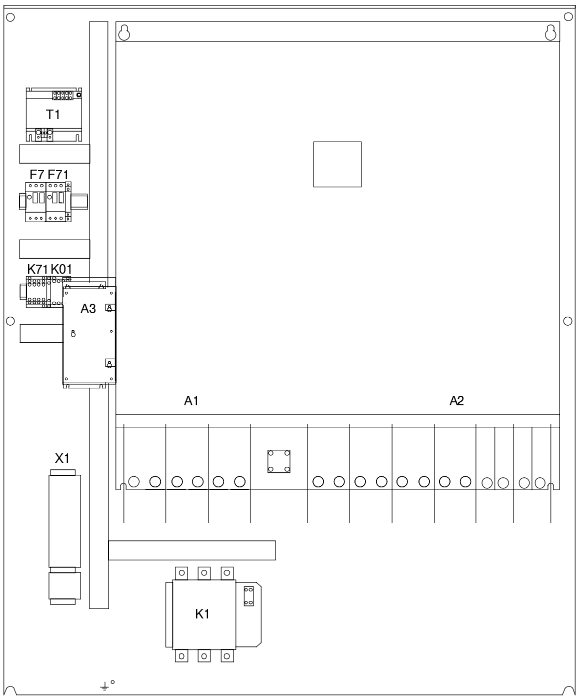


DynAC V 315-400 F-A-x-x-0-0

Dimensions WxHxD
1270x1540x425 mm

Weight (approx.)
315F-A 380kg
400F-A 390kg

Requires external resistors



F-series

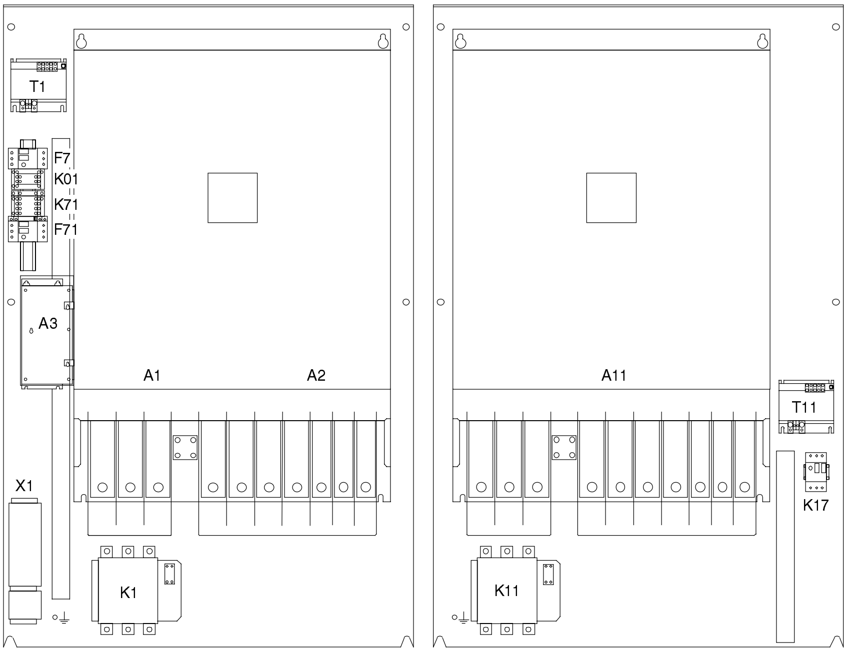
DynAC V 500 F-A-x-x-0-0

Dimensions WxHxD
2x910x1435x422 mm

Weight (approx.)
500F-A 2x300kg

The device consists of two units build side by side.

Requires external resistors



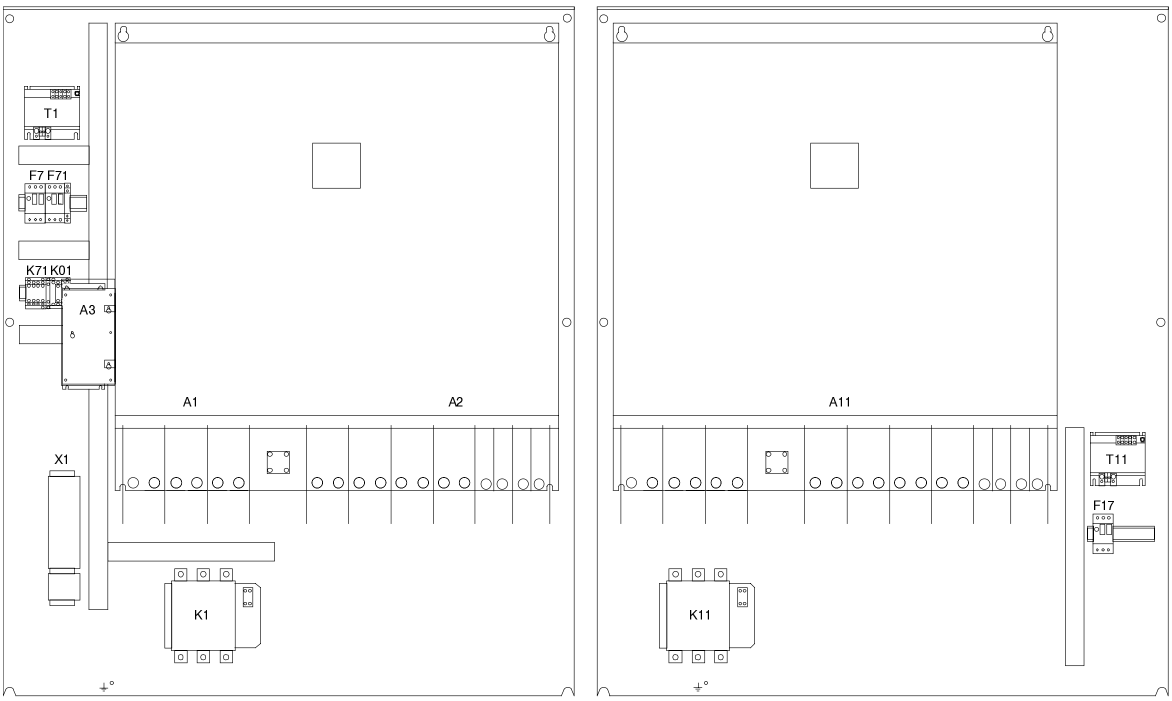
DynAC V 630-800 F-A-x-x-0-0

Dimensions WxHxD
2x1270x1540x425 mm

Weight (approx.)
630F-A 2x380kg
800F-A 2x390kg

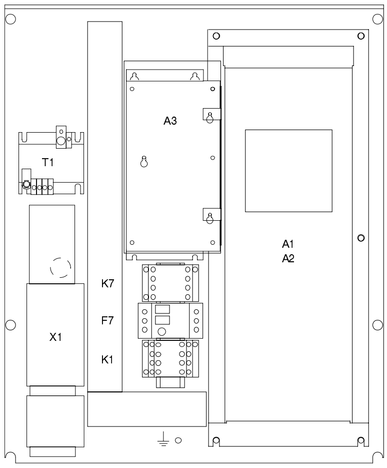
The device consists of two units build side by side.

Requires external resistors



K-series

DynAC V 2.2-7.5 K-B-x-x-0-0

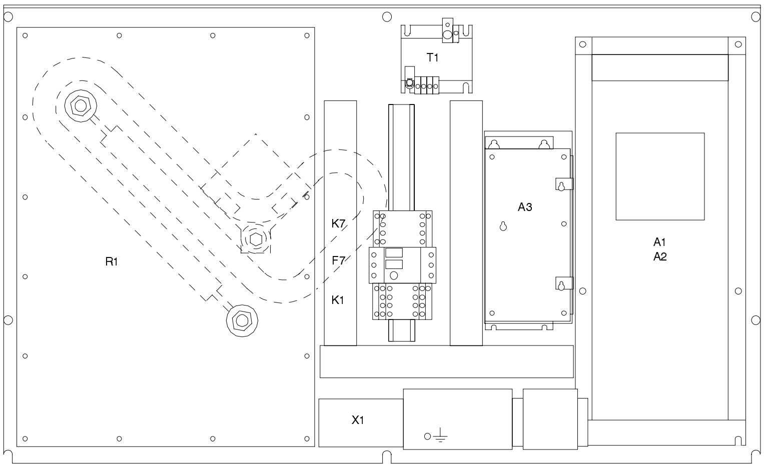


Dimensions WxHxD
467.5x565x265 mm

Weight (approx.)
2.2 K-B 30kg
3.0 K-B 30kg
4.0 K-B 31kg
5.5 K-B 31kg
7.5 K-B 31kg

Through-wall construction

DynAC V 11-15 K-B-x-x-0-0

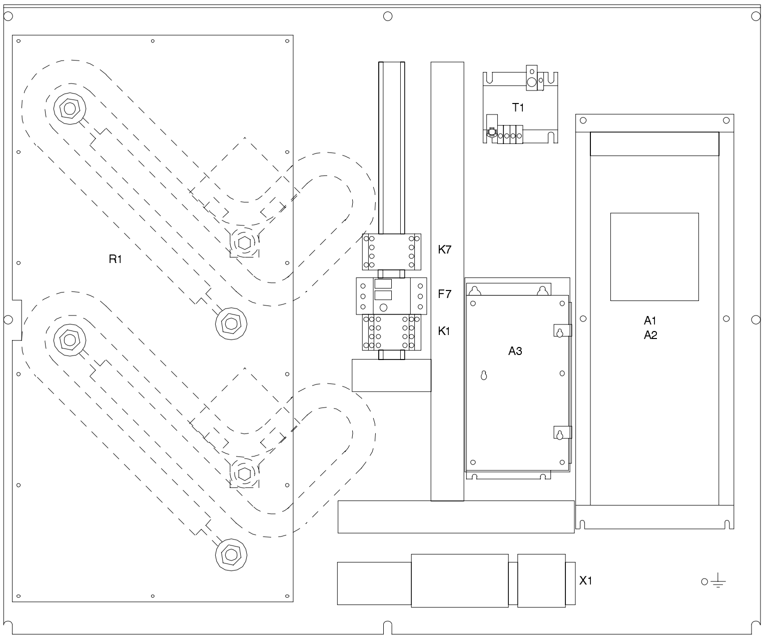


Dimensions WxHxD
940x565x265 mm

Weight (approx.)
11 K-B 39kg
15 K-B 39kg

Through-wall construction

DynAC V 18.5-22 K-B-x-x-0-0

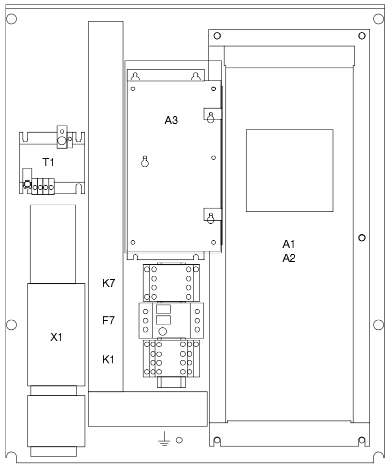


Dimensions WxHxD
940x786x265 mm

Weight (approx.)
18.5 K-B 48kg
22 K-B 48kg

Through-wall construction

K-series



DynAC V 2.2-22 K-A-x-x-0-0

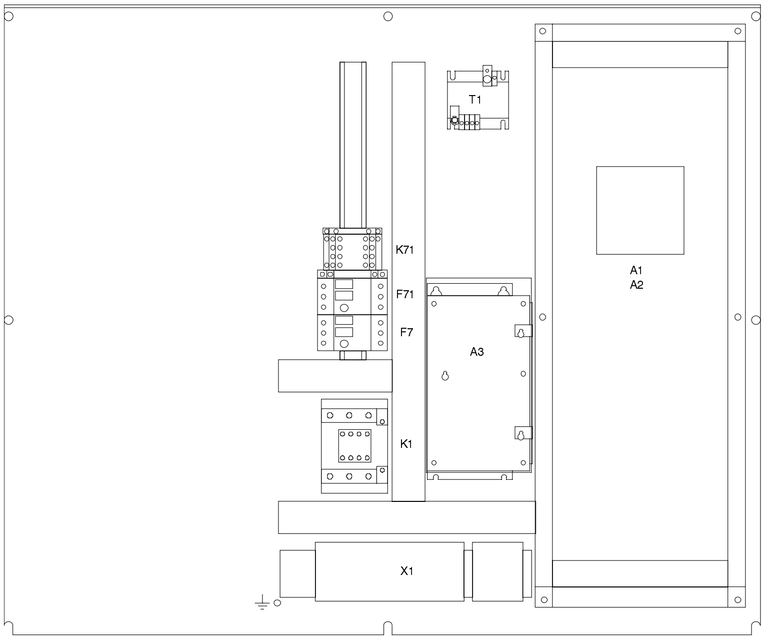
Dimensions WxHxD
467.5x565x265 mm

Weight (approx.)

4.0 K-A	29kg	11 K-A	29kg
5.5 K-A	29kg	15 K-A	29kg
7.5 K-A	29kg	18.5 K-A	29kg
		22 K-A	29kg

Through-wall construction

Requires external resistors



DynAC V 30-75 K-A-x-x-0-0

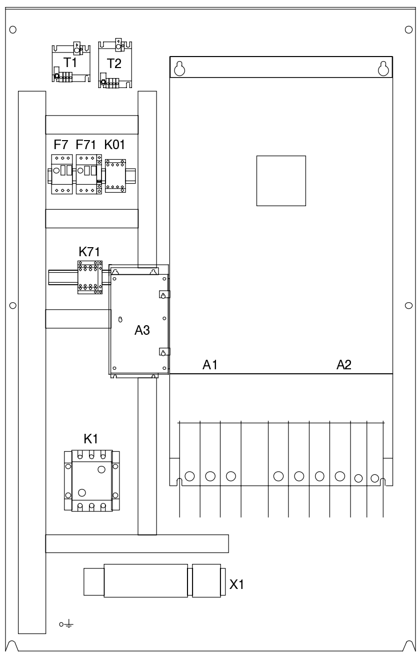
Dimensions WxHxD
940x786x290 mm

Weight (approx.)

30 K-A	62kg
37 K-A	62kg
45 K-A	62kg
55 K-A	62kg
75 K-A	62kg

Through-wall construction

Requires external resistors



DynAC V 90-132 K-A-x-x-0-0

Dimensions WxHxD
910x1435x385 mm

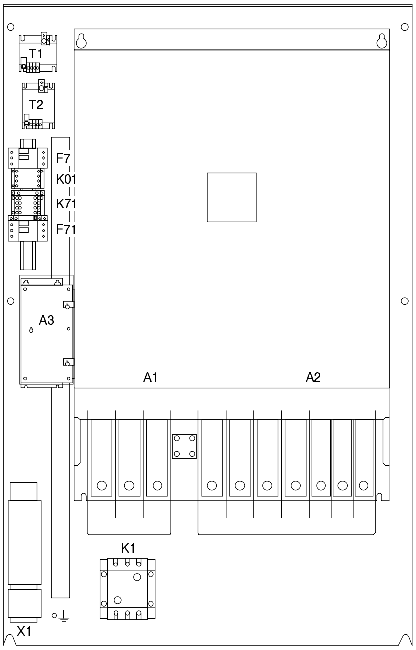
Weight (approx.)

90 K-A	215kg
110 K-A	223kg
132 K-A	225kg

Requires external resistors

K-series

DynAC V 160-200 K-A-x-x-0-0

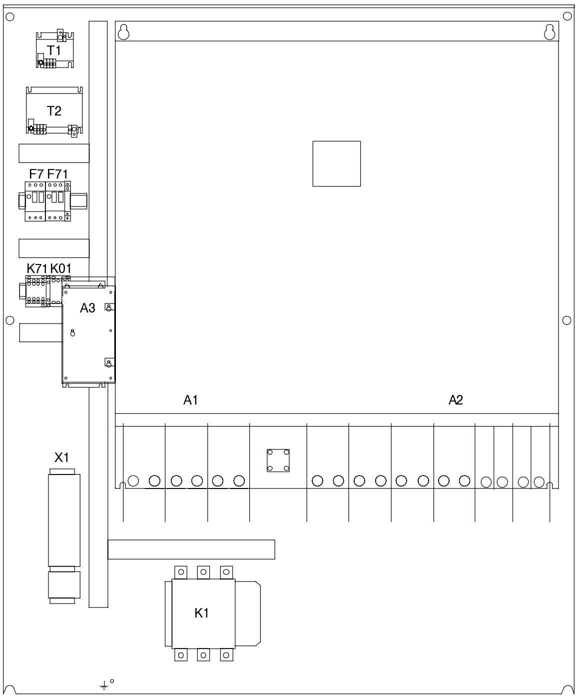


Dimensions WxHxD
910x1435x422 mm

Weight (approx.)
160 K-A 290kg
200 K-A 300kg

Requires external resistors

DynAC V 250-315 K-A-x-x-0-0



Dimensions WxHxD
1270x1540x425 mm

Weight (approx.)
250 K-A 380kg
315 K-A 390kg

Requires external resistors

K-series

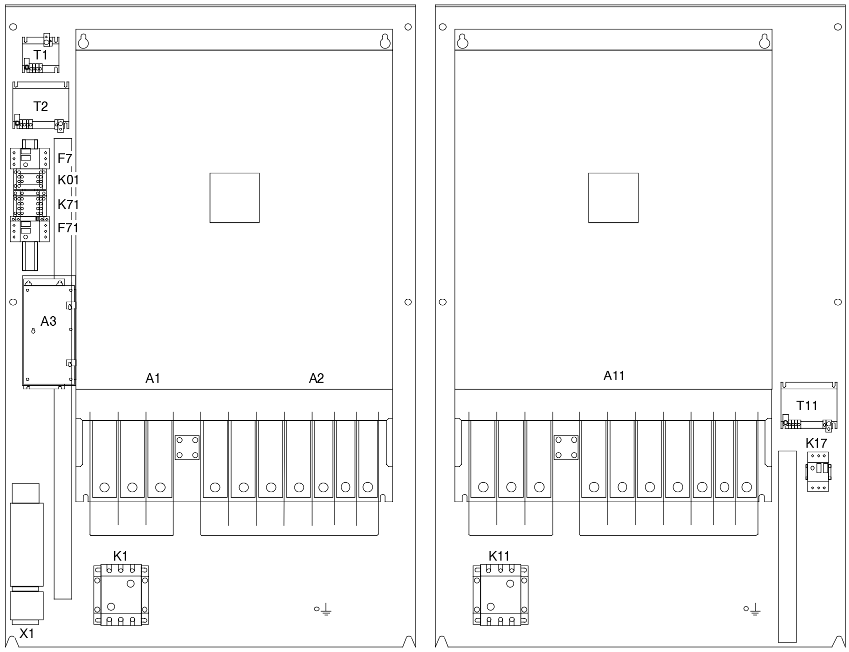
DynAC V 400 K-A-x-x-0-0

Dimensions WxHxD
2x910x1435x422 mm

Weight (approx.)
400 K-A 2x300kg

The device consists of two units build side by side.

Requires external resistors



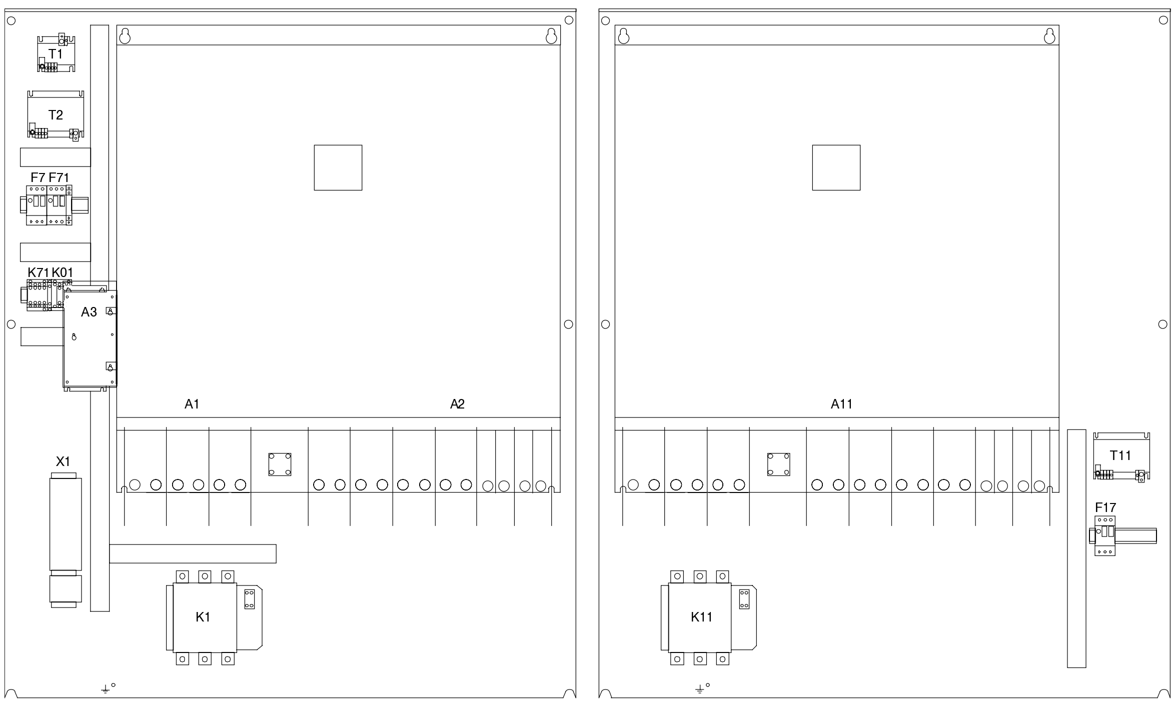
DynAC V 500-630 K-A-x-x-0-0

Dimensions WxHxD
2x1270x1540x425 mm

Weight (approx.)
500 K-A 2x380kg
630 K-A 2x390kg

The device consists of two units build side by side.

Requires external resistors



Appendix A19 Circuit diagrams of P-models

J-SERIES

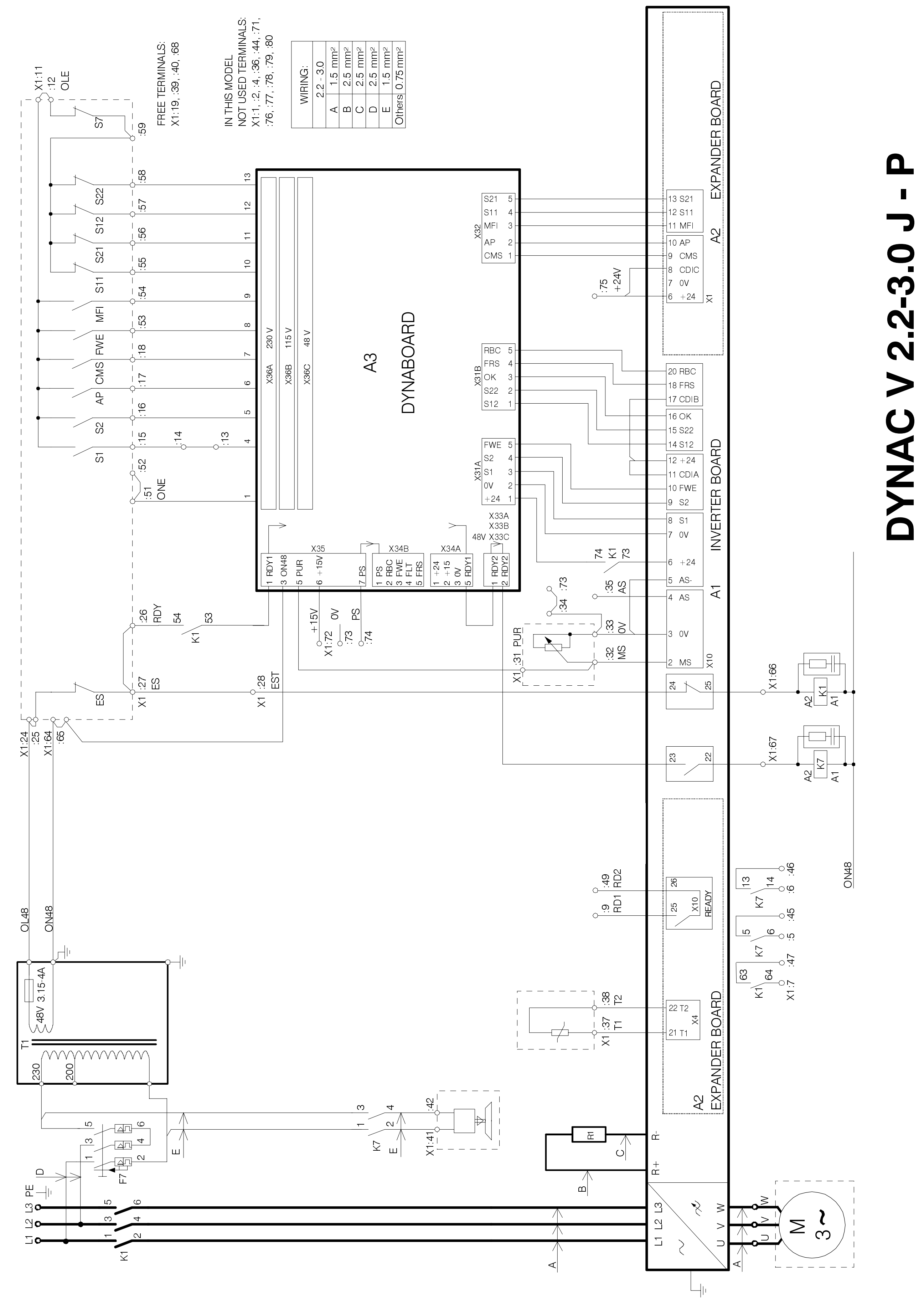
DynAC V 2.2-3.0 J-P
DynAC V 4.0-22 J-P
DynAC V 30-45 J-P

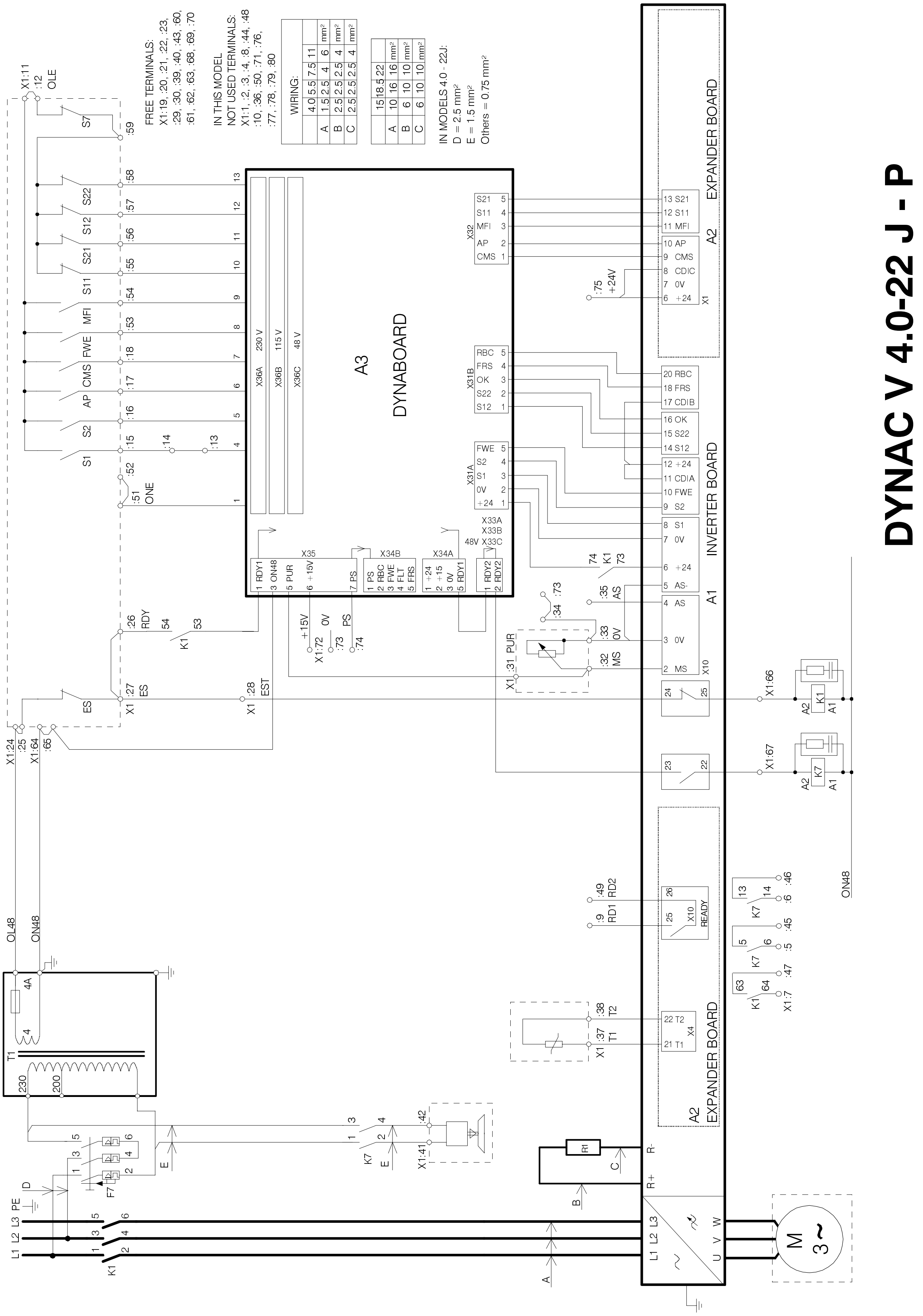
F-SERIES

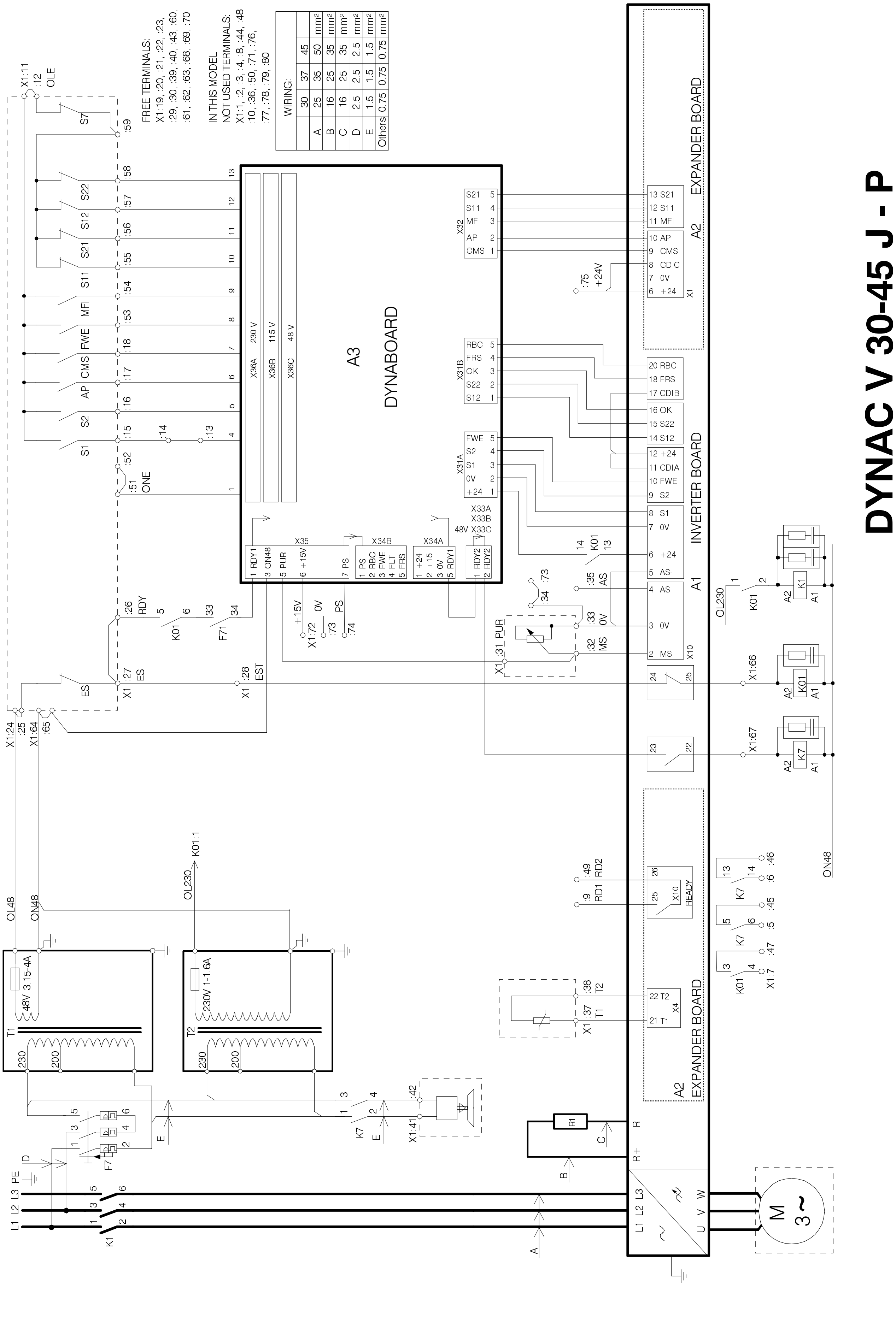
DynAC V 2.2-5.5 F-P
DynAC V 7.5-45 F-P
DynAC V 55-90 F-P

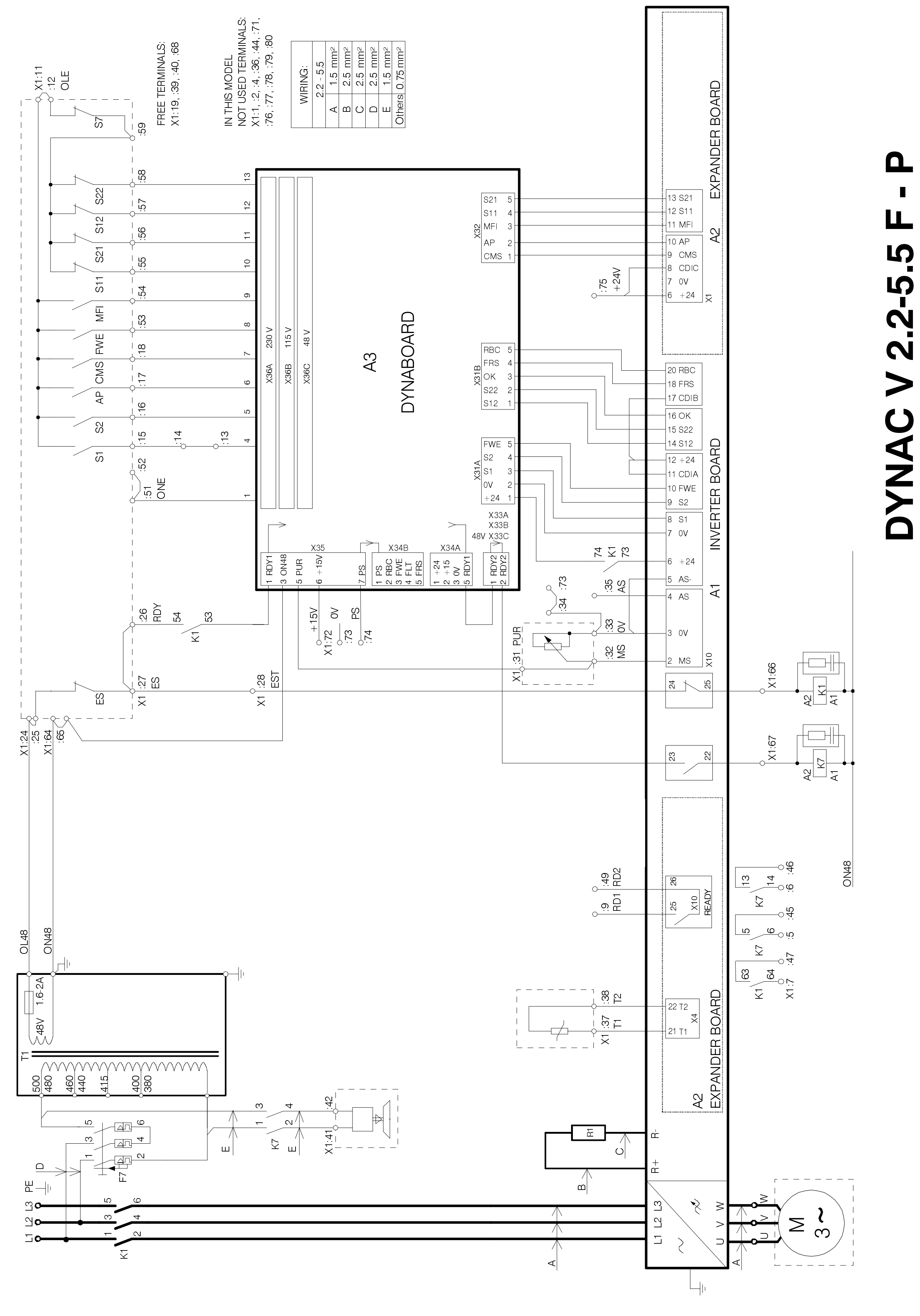
K-SERIES

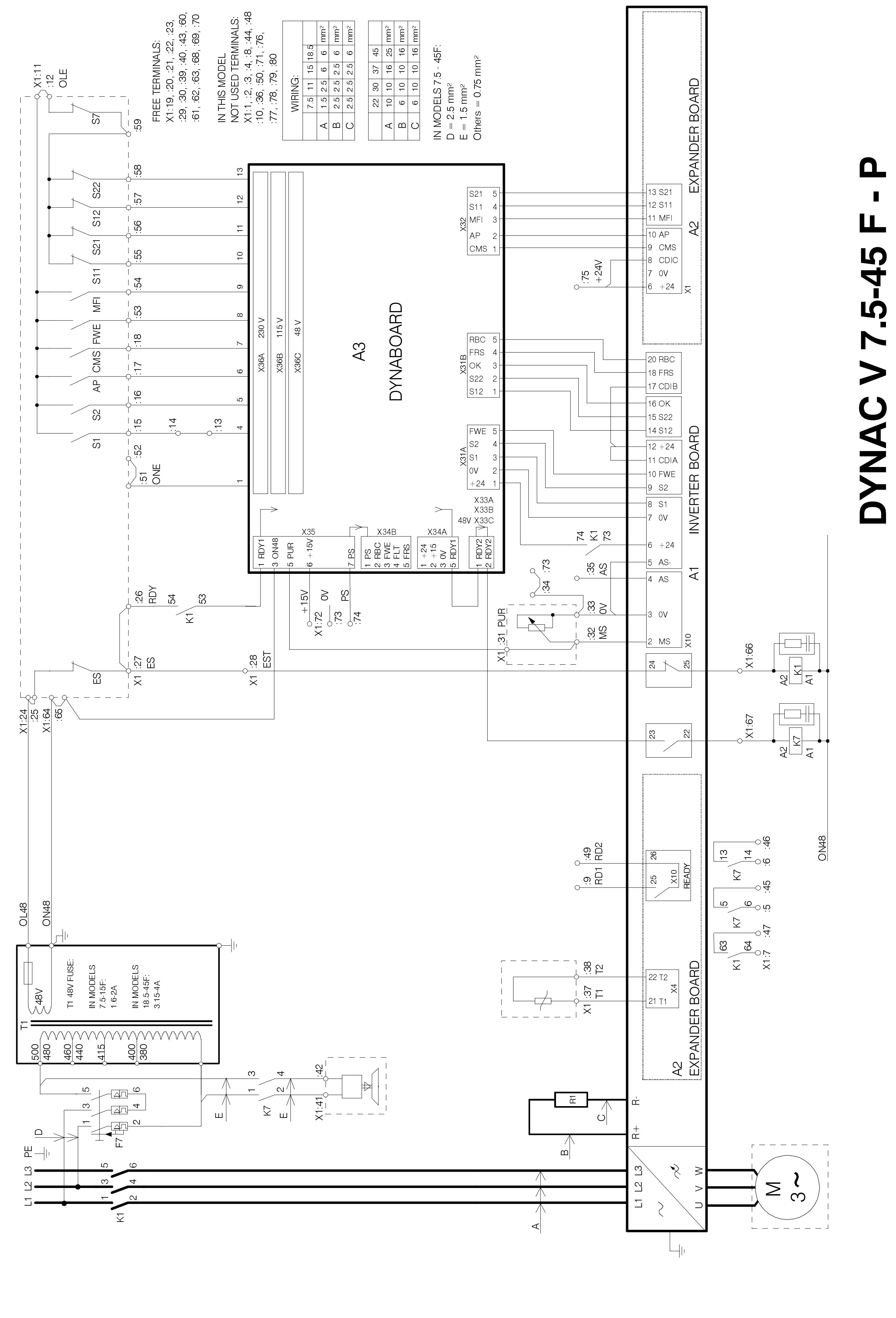
DynAC V 2.2-22 K-P
DynAC V 30-75 K-P

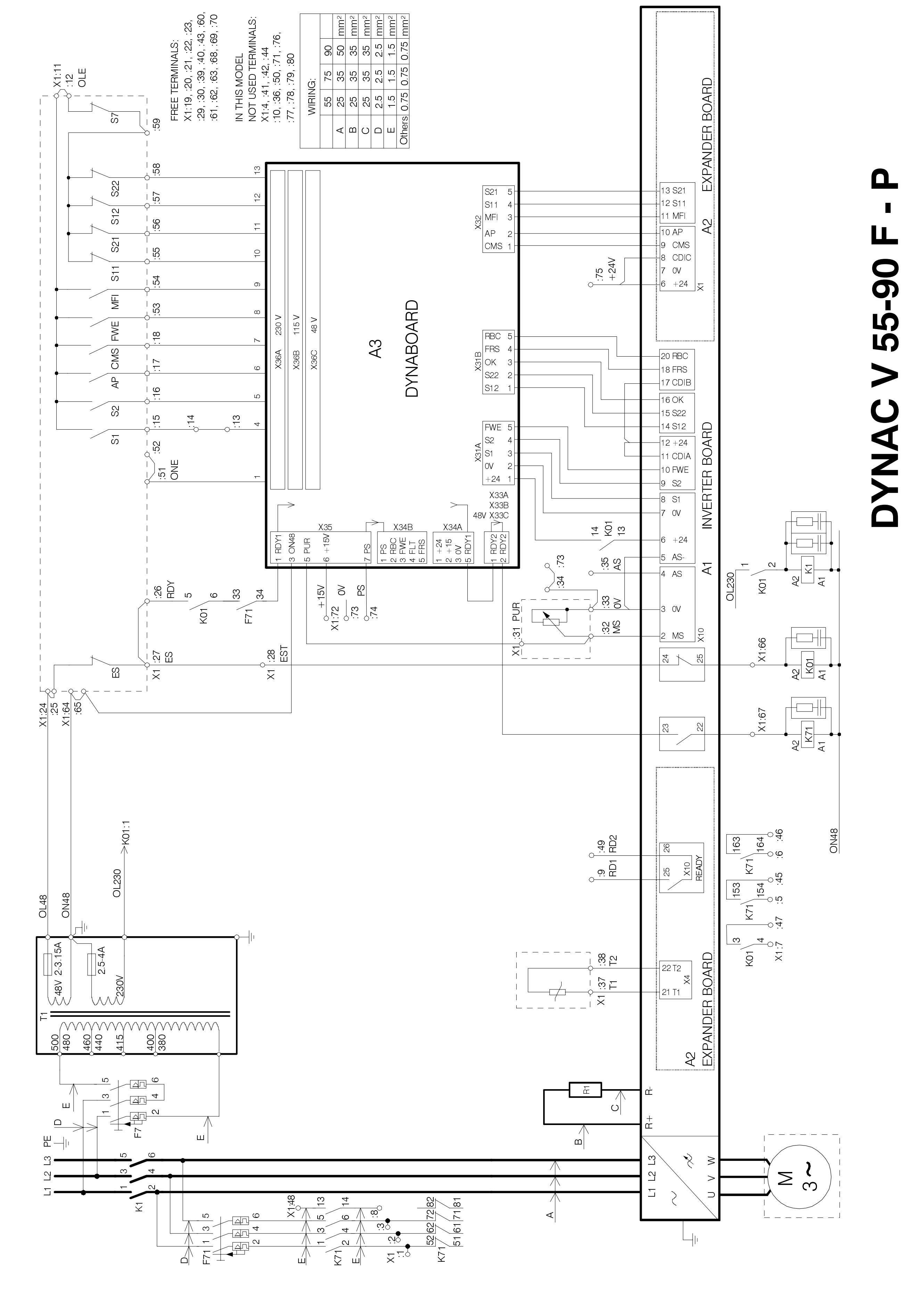

DYNAC V 2.2-3.0 J - P
A3 DYNABOARD
A1 INVERTER BOARD
A2 EXPANDER BOARD
FREE TERMINALS: X1:19, :39, :40, :68
IN THIS MODEL NOT USED TERMINALS: X1:1, :2, :4, :36, :44, :71, :76, :77, :78, :79, :80
WIRING: 2.2 - 3.0
A 1.5 mm²
B 2.5 mm²
C 2.5 mm²
D 2.5 mm²
E 1.5 mm²
Others 0.75 mm²

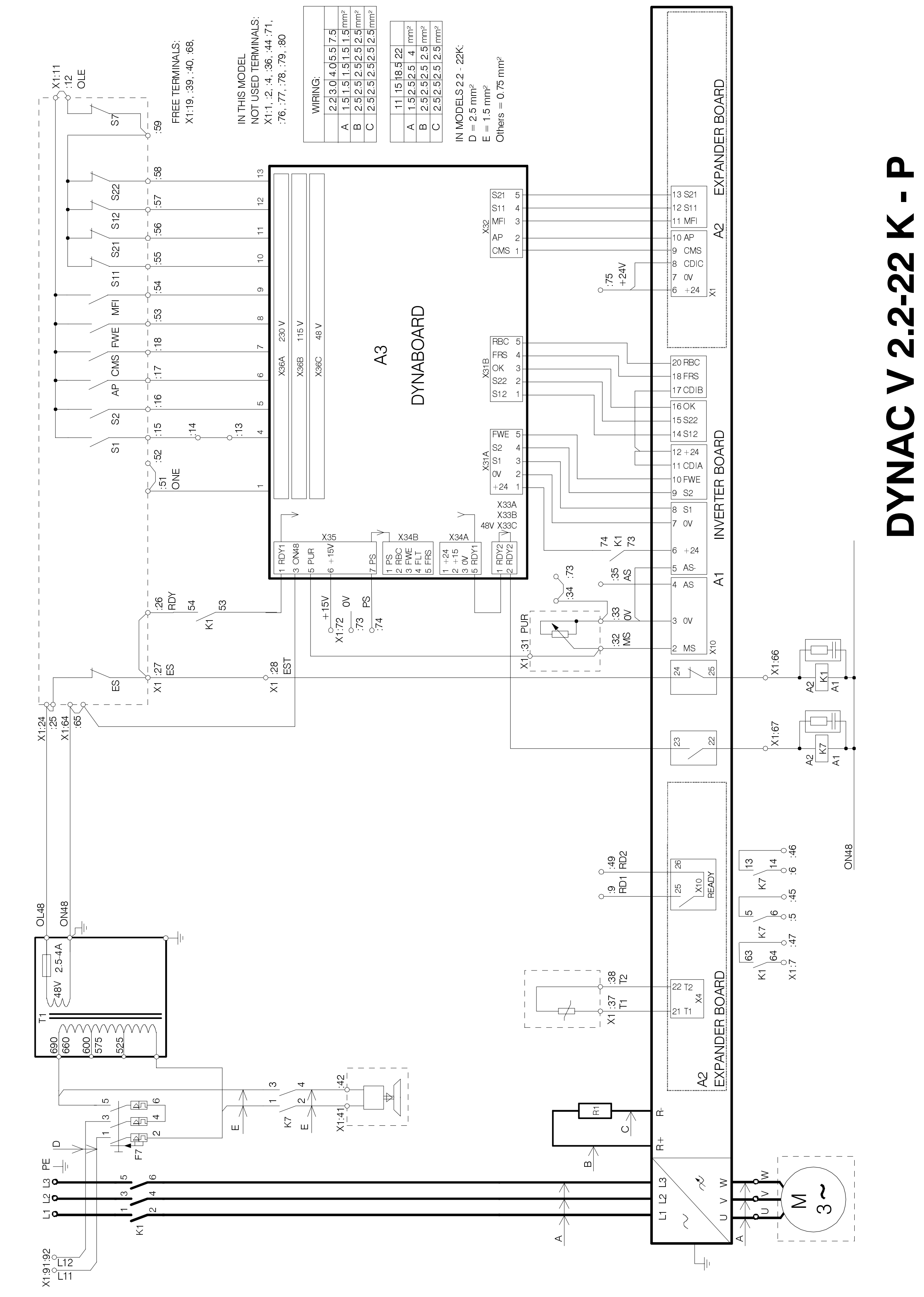

DYNAC V 4.0-22 J - P
FREE TERMINALS:
X1:19, :20, :21, :22, :23,
:29, :30, :39, :40, :43, :60,
:61, :62, :63, :68, :69, :70
IN THIS MODEL
NOT USED TERMINALS:
X1:1, :2, :3, :4, :8, :44, :48
:10, :36, :50, :71, :76,
:77, :78, :79, :80
WIRING:
4.0 5.5 7.5 11
A 1.5 2.5 4 6 mm²
B 2.5 2.5 2.5 4 mm²
C 2.5 2.5 2.5 4 mm²
15 18.5 22
A 10 16 16 mm²
B 6 10 10 mm²
C 6 10 10 mm²
IN MODELS 4.0 - 22J:
D = 2.5 mm²
E = 1.5 mm²
Others = 0.75 mm²
A3
DYNABOARD
A2 EXPANDER BOARD
A1 INVERTER BOARD

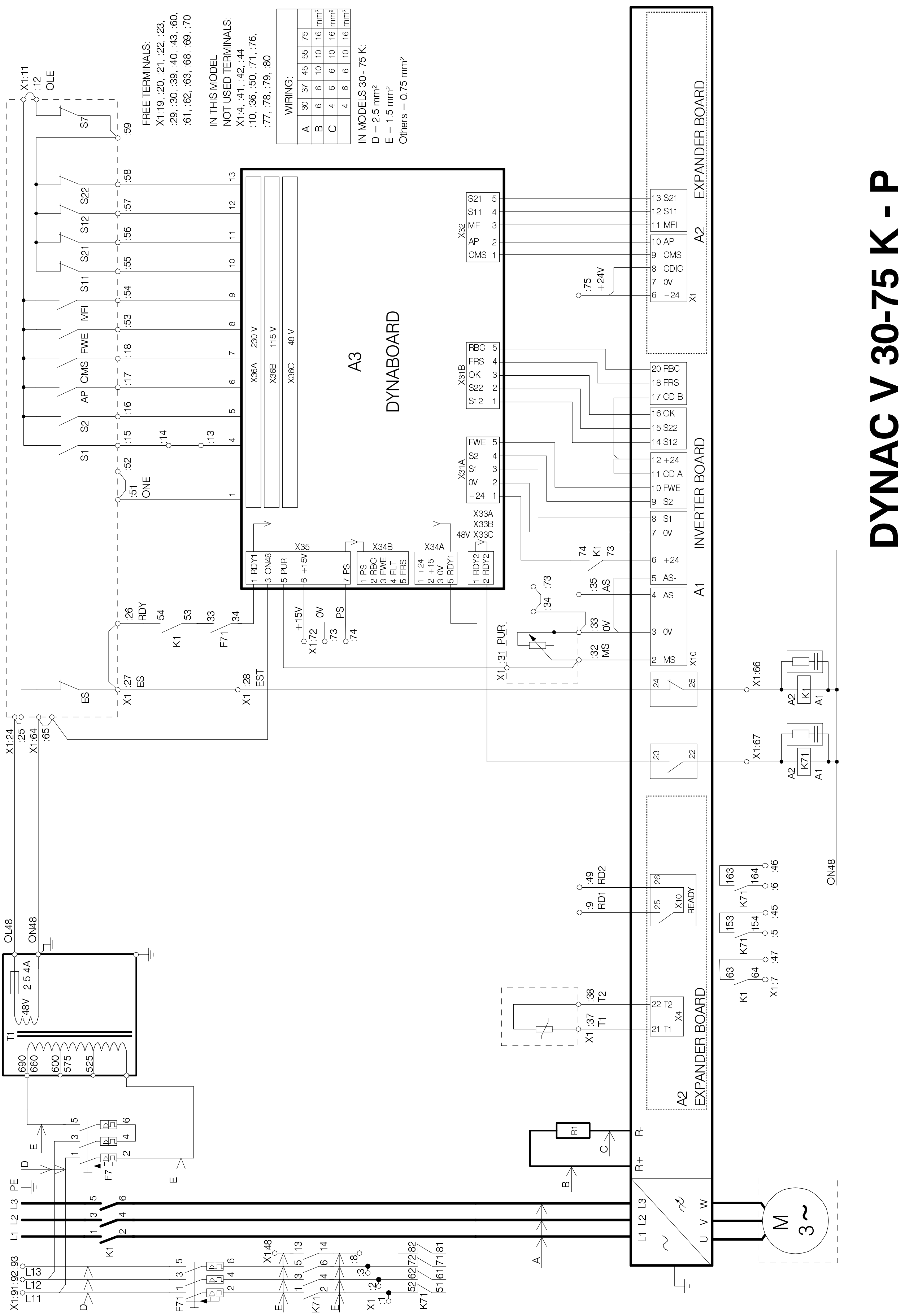

DYNAC V 30-45 J - P
FREE TERMINALS:
X1:19, :20, :21, :22, :23, :29, :30, :39, :40, :43, :60, :61, :62, :63, :68, :69, :70
IN THIS MODEL NOT USED TERMINALS:
X1:1, :2, :3, :4, :8, :44, :48, :10, :36, :50, :71, :76, :77, :78, :79, :80
WIRING:
30 37 45
A 25 35 50 mm²
B 16 25 35 mm²
C 16 25 35 mm²
D 2.5 2.5 2.5 mm²
E 1.5 1.5 1.5 mm²
Others 0.75 0.75 0.75 mm²
A3 DYNABOARD
A2 EXPANDER BOARD
A1 INVERTER BOARD
T1 48V 3.15-4A
T2 230V 1-1.6A


DYNAC V 2.2-5.5 F - P
A3
DYNABOARD
A1
INVERTER BOARD
A2
EXPANDER BOARD
FREE TERMINALS:
X1:19, :39, :40, :68
IN THIS MODEL
NOT USED TERMINALS:
X1:1, :2, :4, :36, :44, :71,
:76, :77, :78, :79, :80
WIRING:
2.2 - 5.5
A 1.5 mm²
B 2.5 mm²
C 2.5 mm²
D 2.5 mm²
E 1.5 mm²
Others 0.75 mm²


DYNAC V 7.5-45 F - P
FREE TERMINALS:
X1:19, :20, :21, :22, :23,
:29, :30, :39, :40, :43, :60,
:61, :62, :63, :68, :69, :70
IN THIS MODEL
NOT USED TERMINALS:
X1:1, :2, :3, :4, :8, :44, :48
:10, :36, :50, :71, :76,
:77, :78, :79, :80
WIRING:
7.5 11 15 18.5
A 1.5 2.5 6 6 mm²
B 2.5 2.5 2.5 6 mm²
C 2.5 2.5 2.5 6 mm²
22 30 37 45
A 10 10 16 25 mm²
B 6 10 10 16 mm²
C 6 10 10 16 mm²
IN MODELS 7.5 - 45F:
D = 2.5 mm²
E = 1.5 mm²
Others = 0.75 mm²
A3
DYNABOARD
A1
INVERTER BOARD
A2
EXPANDER BOARD
T1 48V FUSE:
IN MODELS
7.5-15F:
1.6:2A
IN MODELS
18.5-45F:
3.15:4A


DYNAC V 55-90 F - P
A3
DYNABOARD
A1
INVERTER BOARD
A2
EXPANDER BOARD
FREE TERMINALS:
X1:19, :20, :21, :22, :23, :29, :30, :39, :40, :43, :60, :61, :62, :63, :68, :69, :70
IN THIS MODEL NOT USED TERMINALS:
X1:4, :41, :42, :44 :10, :36, :50, :71, :76, :77, :78, :79, :80
WIRING:
T1
M 3~


DYNAC V 2.2-22 K - P
A3
DYNABOARD
A1
INVERTER BOARD
A2
EXPANDER BOARD
FREE TERMINALS:
X1:19, :39, :40, :68.
IN THIS MODEL
NOT USED TERMINALS:
X1:1, :2, :4, :36, :44 :71,
:76, :77, :78, :79, :80
IN MODELS 2.2 - 22K:
D = 2.5 mm²
E = 1.5 mm²
Others = 0.75 mm²


DYNAC V 30-75 K - P
FREE TERMINALS: X1:19, :20, :21, :22, :23, :29, :30, :39, :40, :43, :60, :61, :62, :63, :68, :69, :70
IN THIS MODEL NOT USED TERMINALS: X1:4, :41, :42, :44 :10, :36, :50, :71, :76, :77, :78, :79, :80
WIRING:
IN MODELS 30 - 75 K: D = 2.5 mm² E = 1.5 mm² Others = 0.75 mm²
A3 DYNABOARD
A2 EXPANDER BOARD
A1 INVERTER BOARD

Appendix A20 Circuit diagrams of N-models

J-SERIES

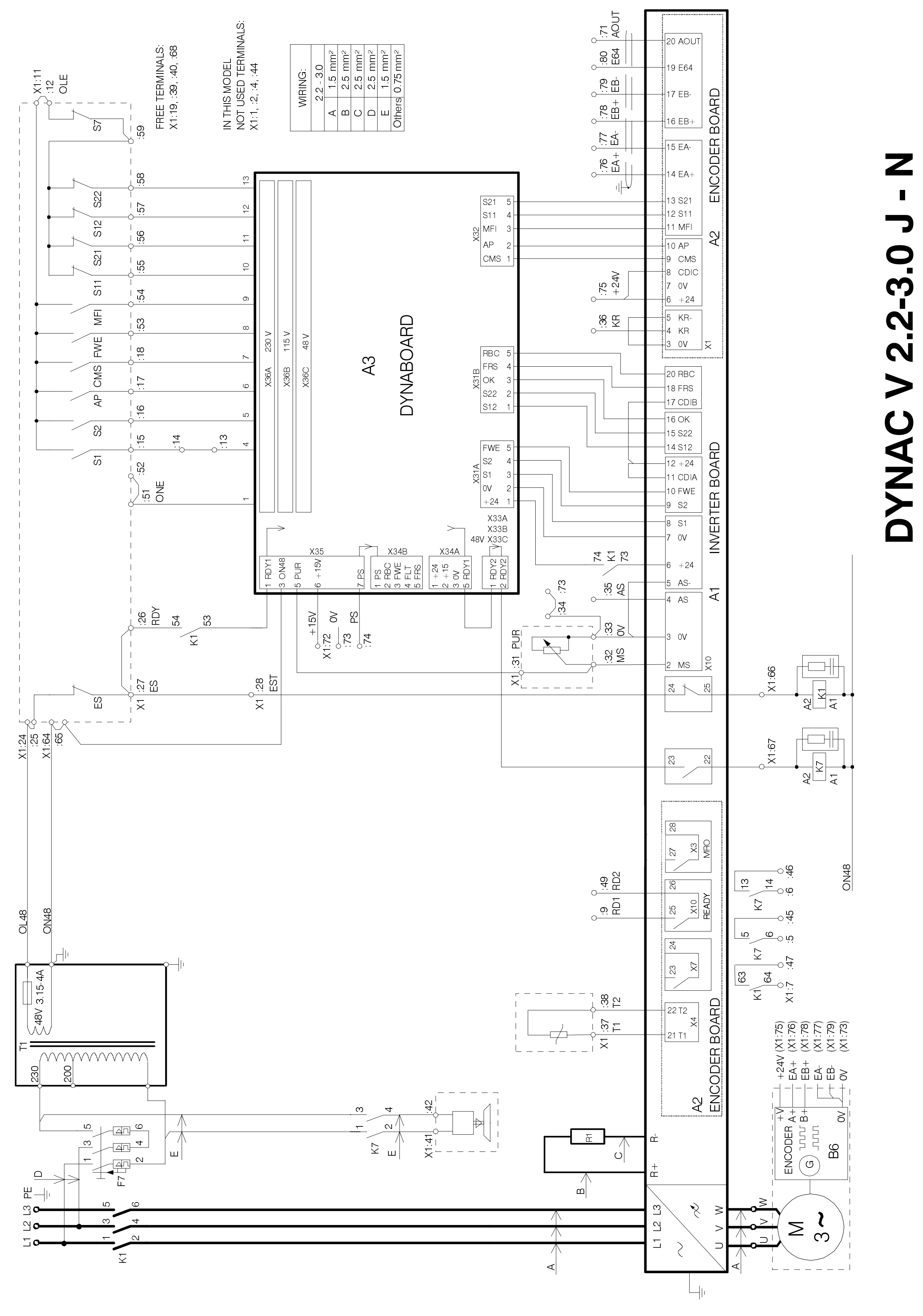
DynAC V 2.2-3.0 J-N
DynAC V 4.0-22 J-N
DynAC V 30-45 J-N

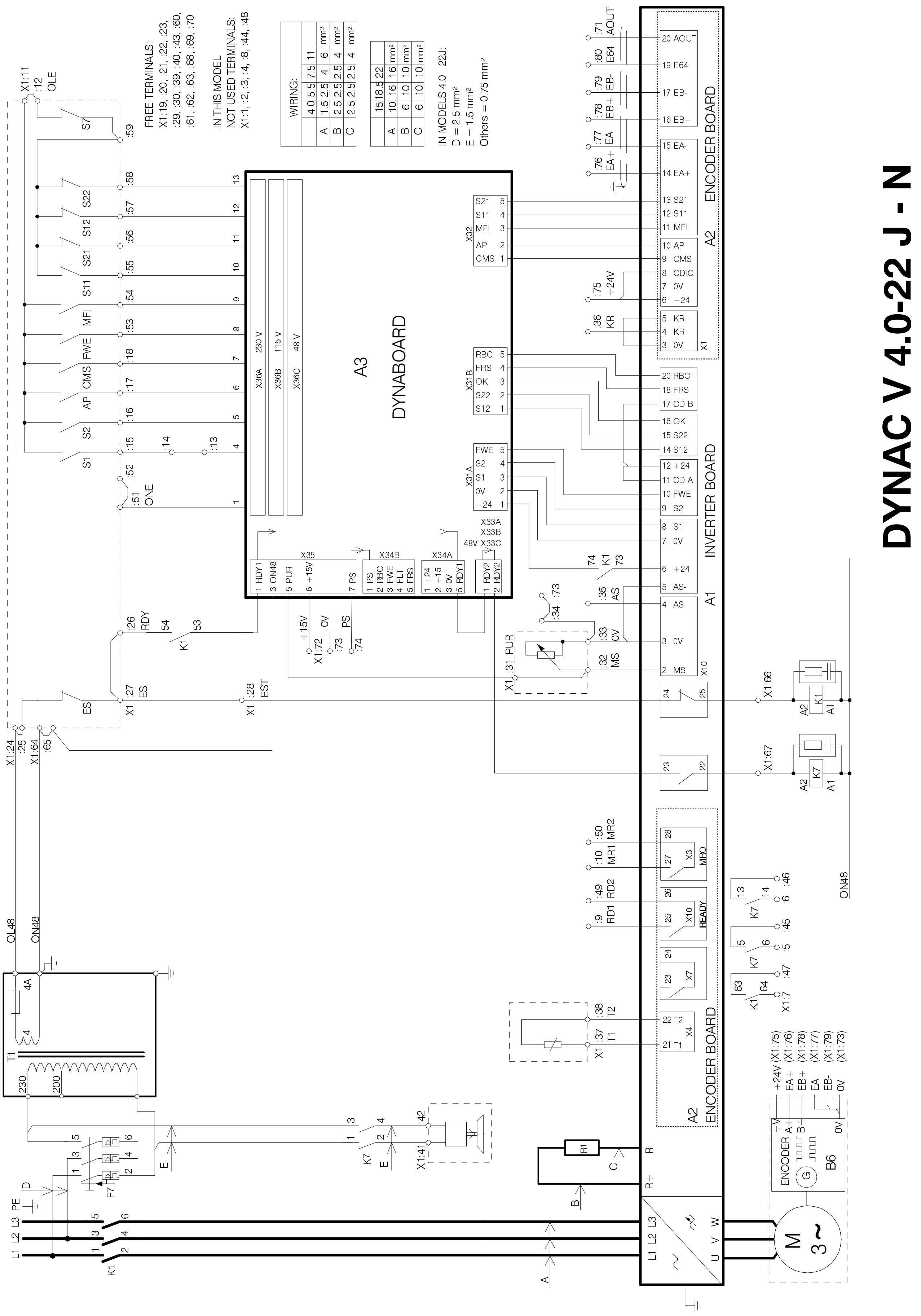
F-SERIES

DynAC V 2.2-5.5 F-N
DynAC V 7.5-45 F-N
DynAC V 55-90 F-N
DynAC V 110-160 F-N
DynAC V 200-250 F-N
DynAC V 315 F-N
DynAC V 400 F-N
DynAC V 500-800 F-N

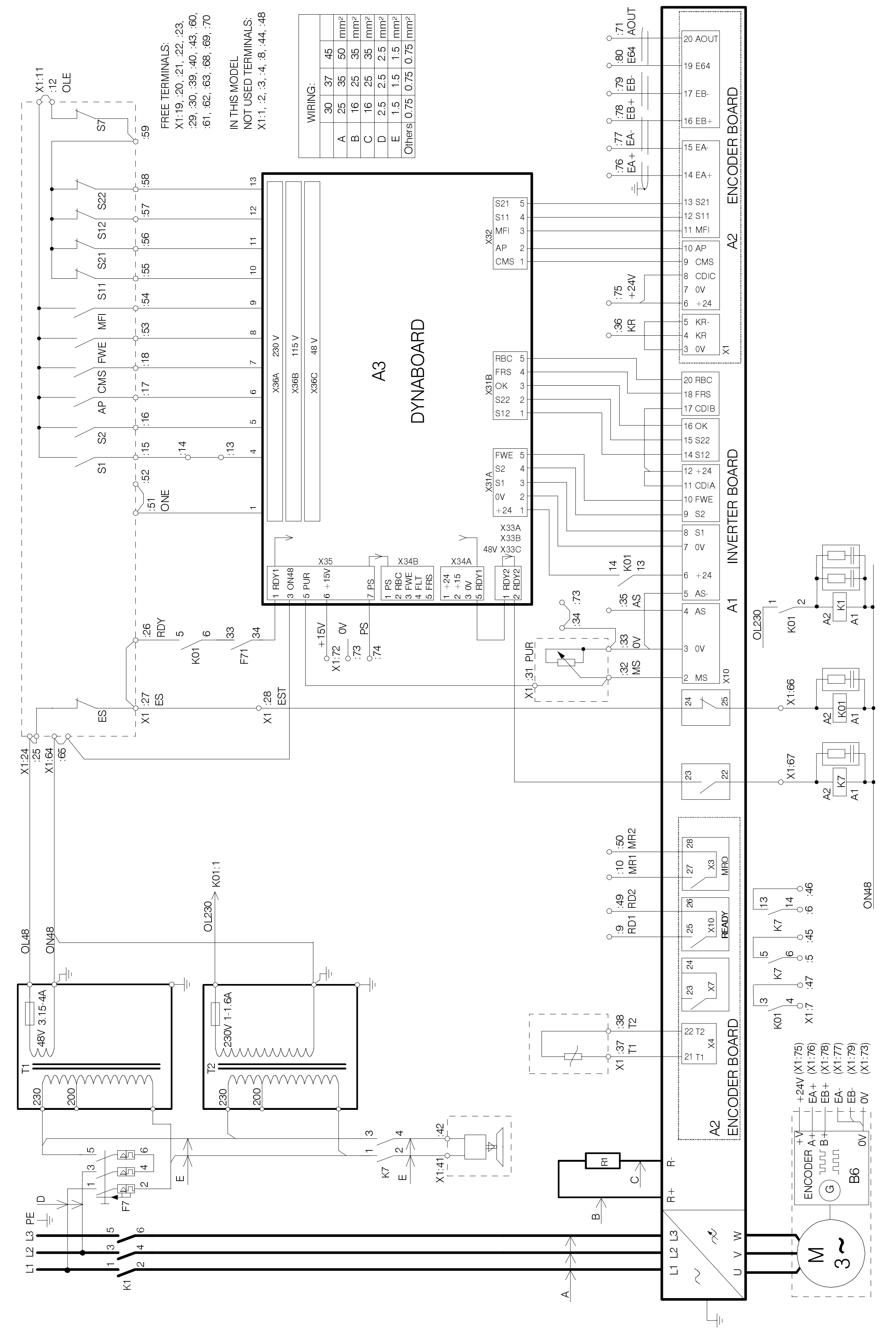
K-SERIES

DynAC V 2.2-22 K-N
DynAC V 30-75 K-N
DynAC V 90-132 K-N
DynAC V 160-200 K-N
DynAC V 250-315 K-N
DynAC V 400-630 K-N


DYNAC V 2.2-3.0 J - N
WIRING:
2.2 - 3.0
A 1.5 mm²
B 2.5 mm²
C 2.5 mm²
D 2.5 mm²
E 1.5 mm²
Others 0.75 mm²
FREE TERMINALS: X1:19, :39, :40, :68
IN THIS MODEL NOT USED TERMINALS: X1:1, :2, :4, :44
A3 DYNABOARD
A2 ENCODER BOARD
A1 INVERTER BOARD
ENCODER B6
T1
F7
K1
K7
R1

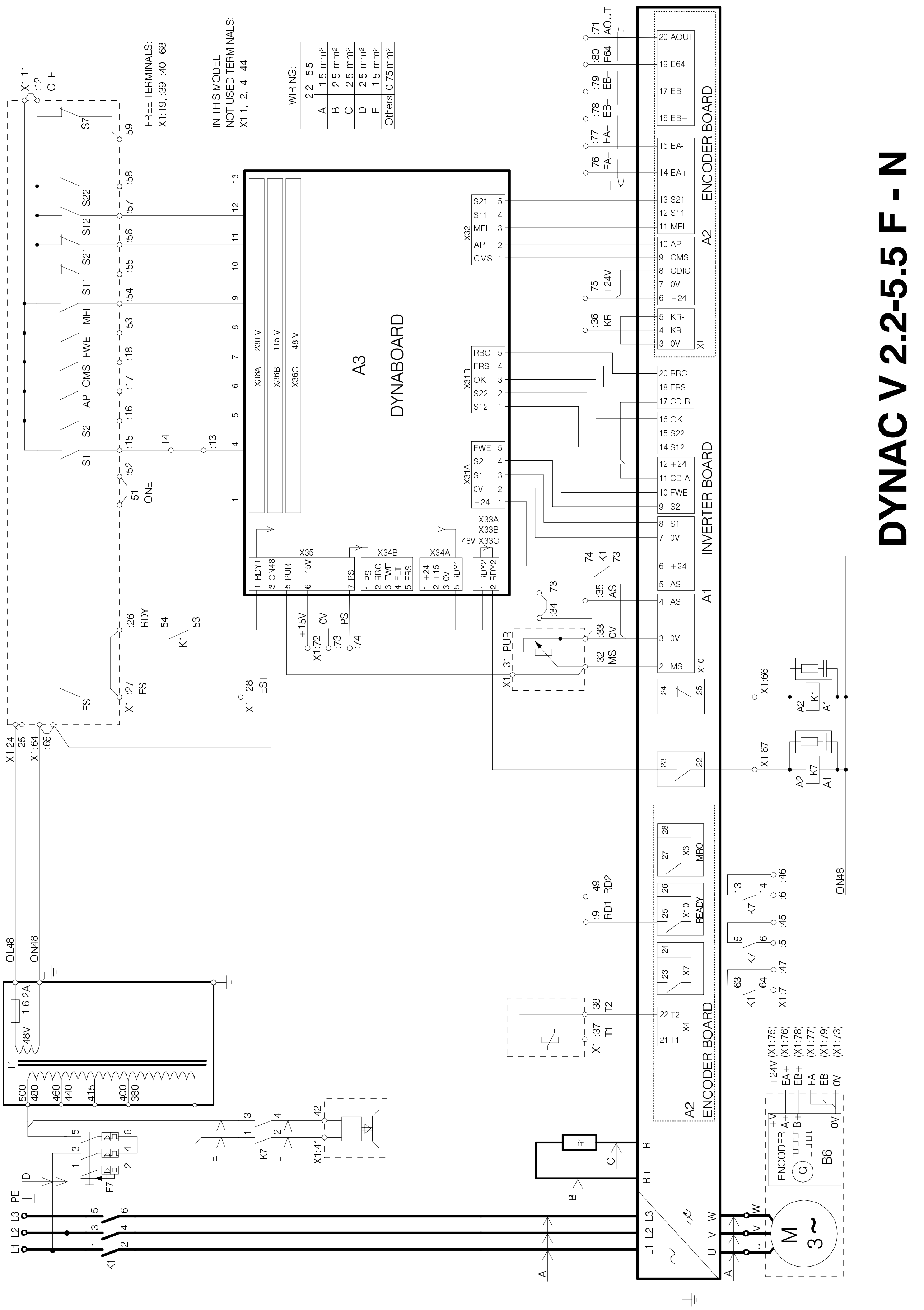

DYNAC V 4.0-22 J - N
A3
DYNABOARD
ENCODER BOARD
INVERTER BOARD
FREE TERMINALS:
X1:19, :20, :21, :22, :23,
:29, :30, :39, :40, :43, :60,
:61, :62, :63, :68, :69, :70
IN THIS MODEL
NOT USED TERMINALS:
X1:1, :2, :3, :4, :8, :44, :48
IN MODELS 4.0 - 22J:
D = 2.5 mm²
E = 1.5 mm²
Others = 0.75 mm²

DYNAC V 30-45 J - N

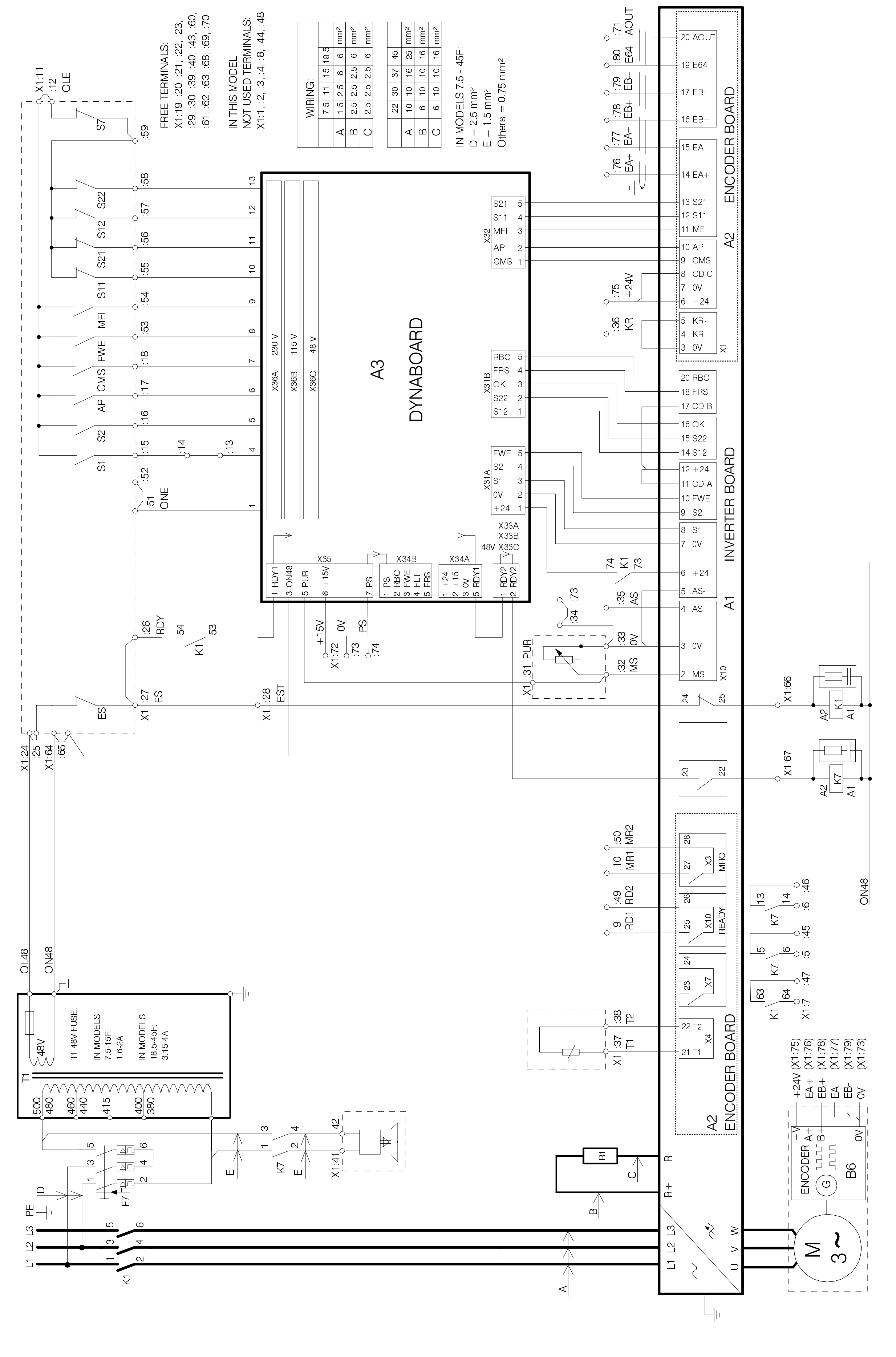


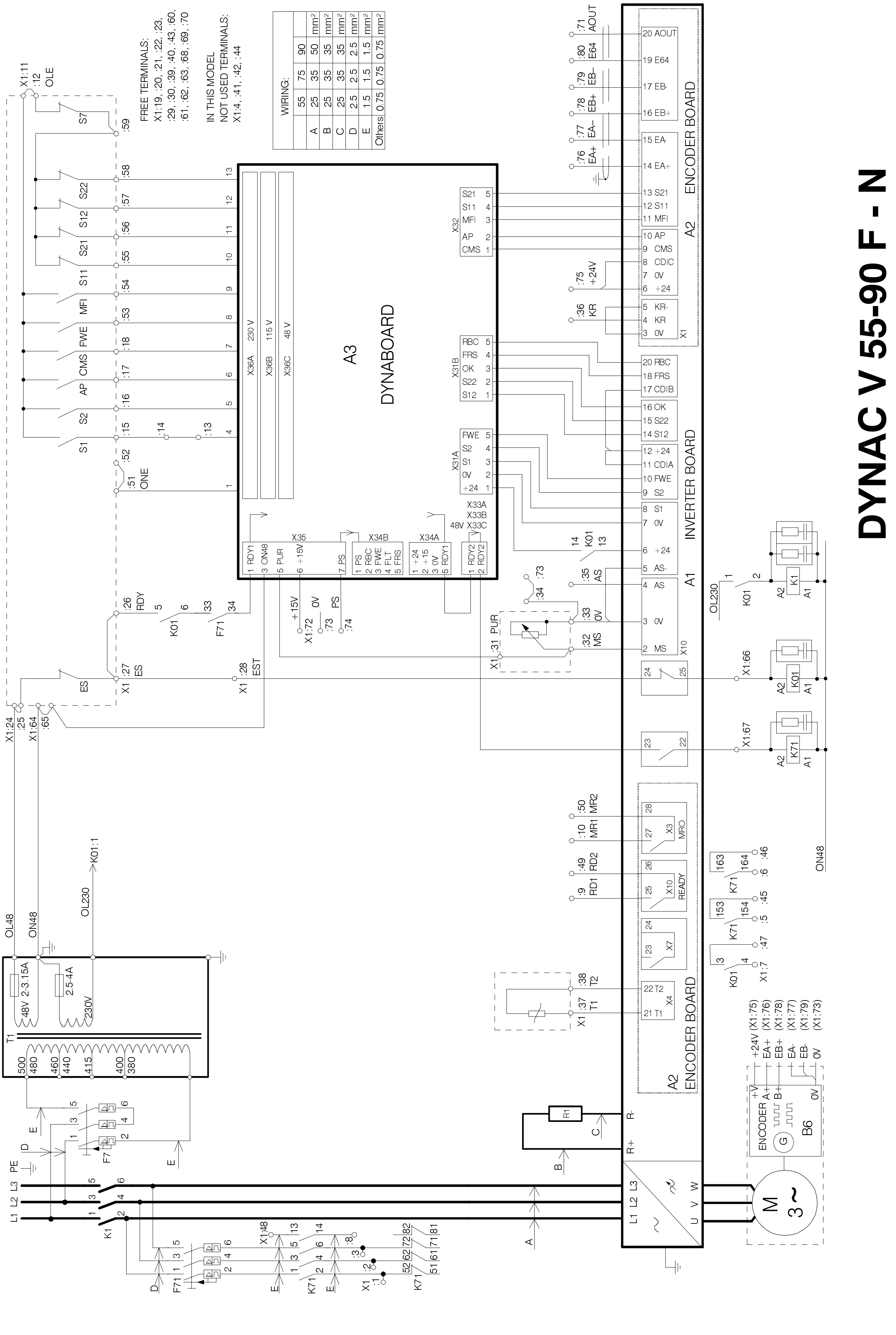
WIRING:

	30	37	45	
A	25	35	50	mm²
B	16	25	35	mm²
C	16	25	35	mm²
D	2.5	2.5	2.5	mm²
E	1.5	1.5	1.5	mm²
Others	0.75	0.75	0.75	mm²

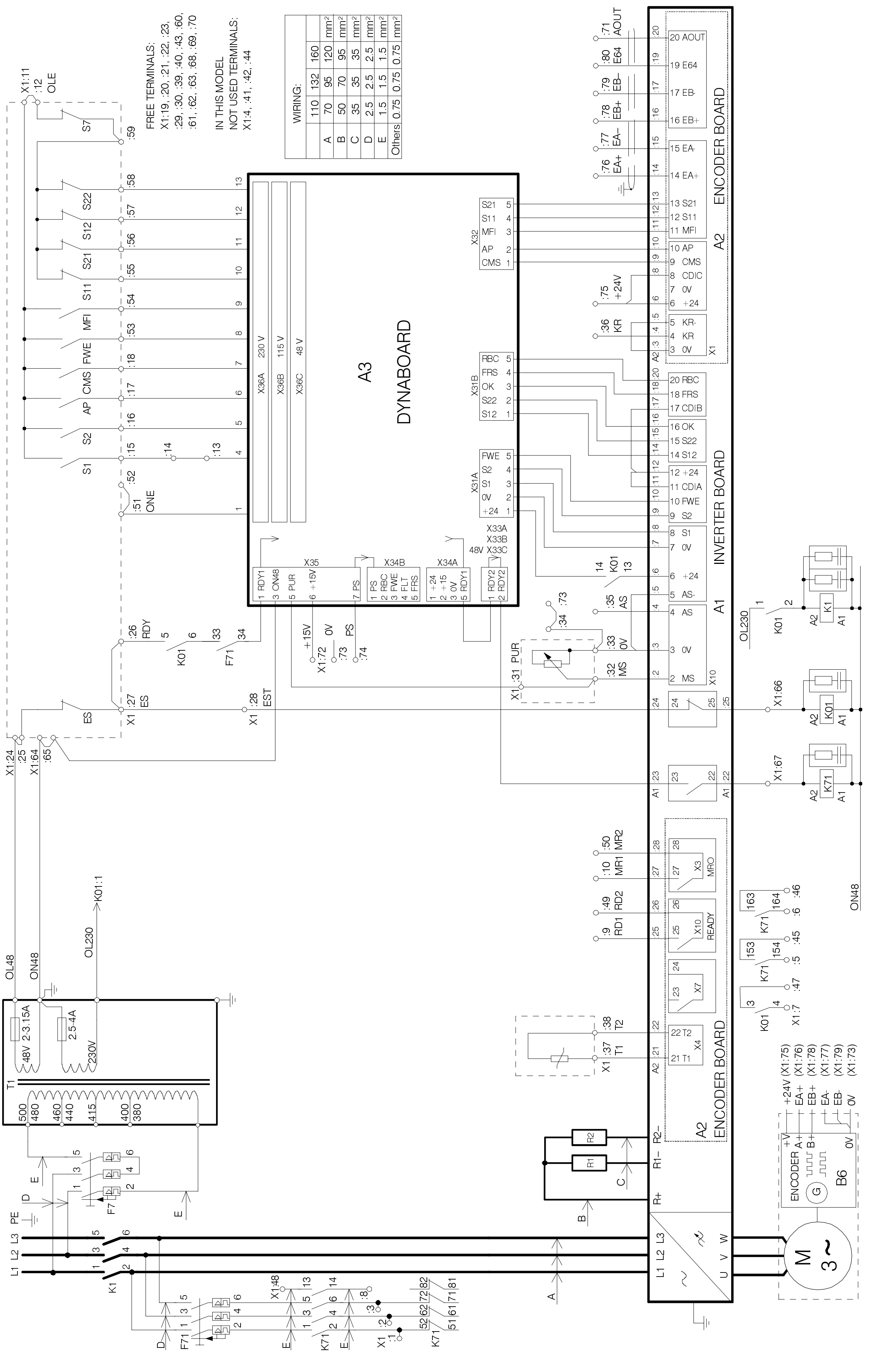

DYNAC V 2.2-5.5 F - N
A3
DYNABOARD
ENCODER BOARD
INVERTER BOARD
FREE TERMINALS:
X1:19, :39, :40, :68
IN THIS MODEL
NOT USED TERMINALS:
X1:1, :2, :4, :44
WIRING:
2.2 - 5.5
A 1.5 mm²
B 2.5 mm²
C 2.5 mm²
D 2.5 mm²
E 1.5 mm²
Others 0.75 mm²

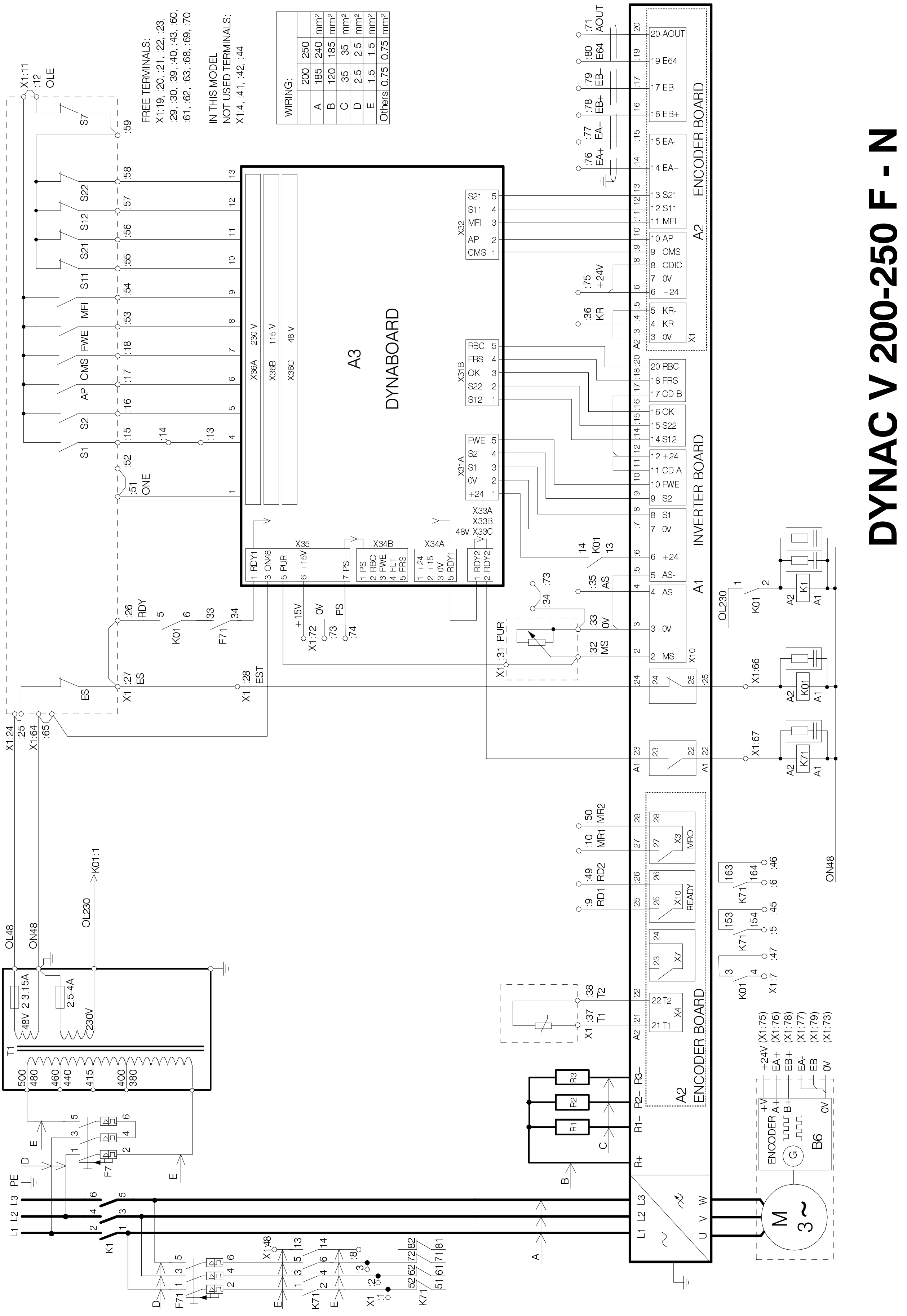
DYNAC V 7.5-45 F - N

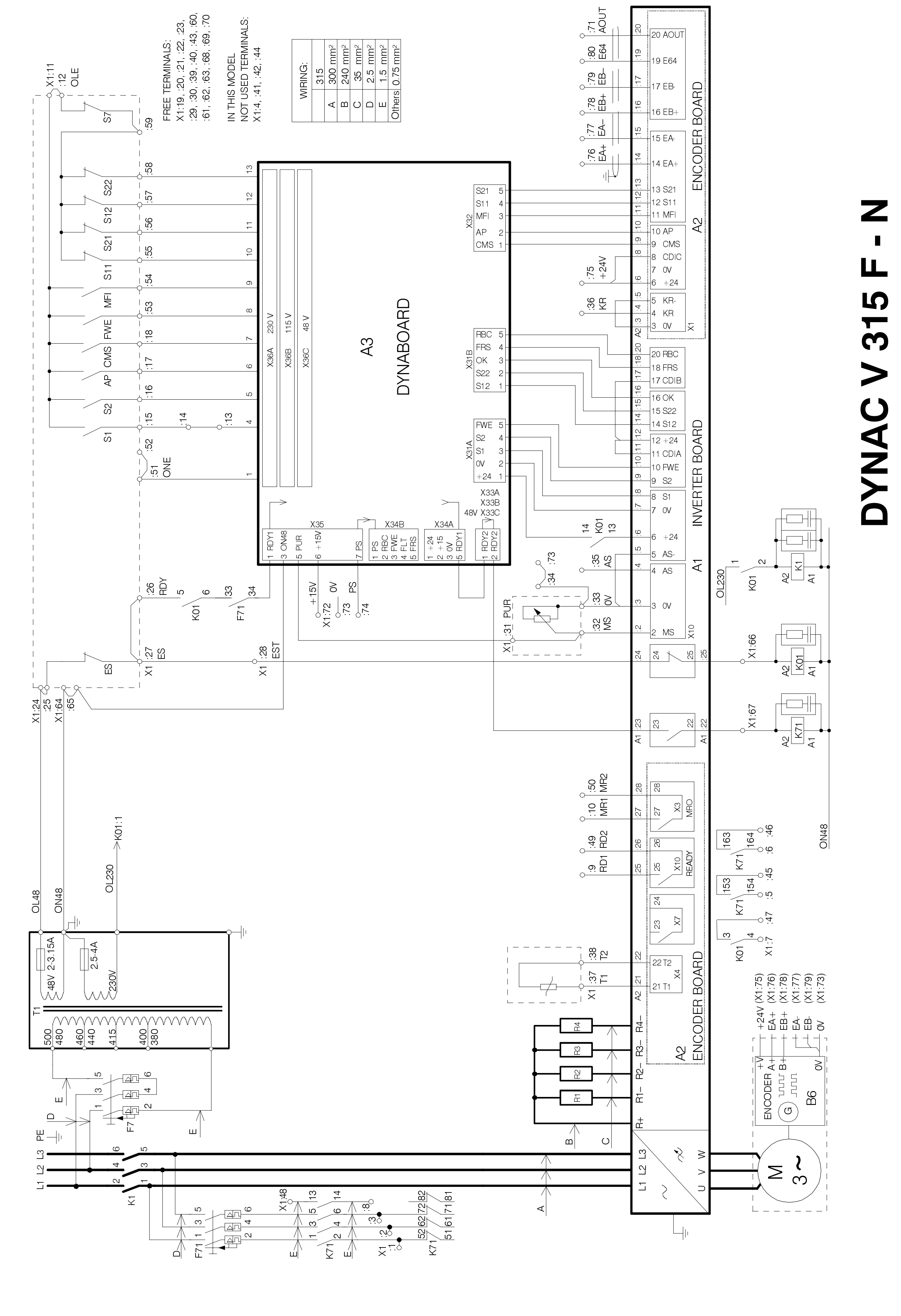


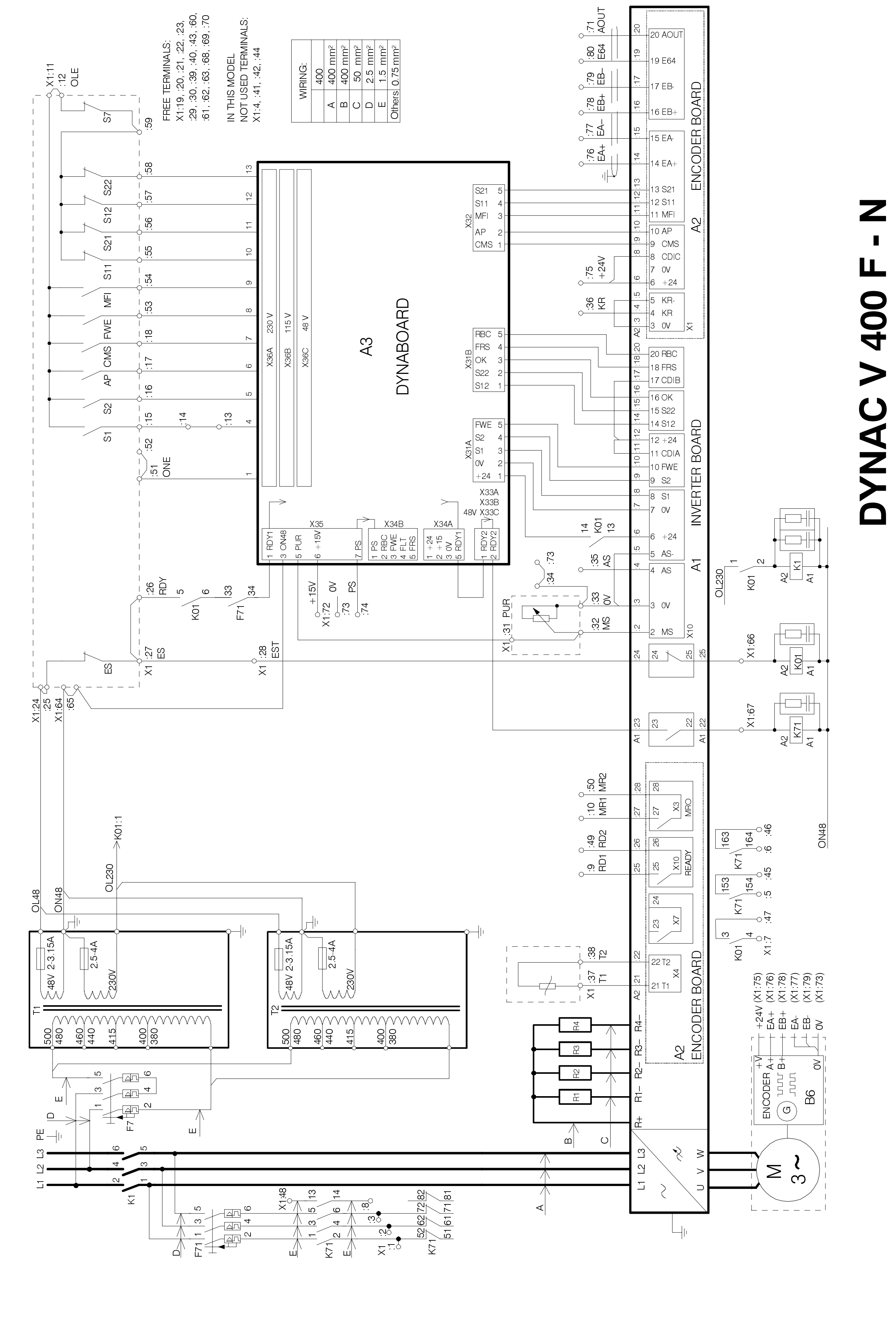

DYNAC V 55-90 F - N
A3
DYNABOARD
A2
ENCODER BOARD
A1
INVERTER BOARD
FREE TERMINALS:
X1:19, :20, :21, :22, :23,
:29, :30, :39, :40, :43, :60,
:61, :62, :63, :68, :69, :70
IN THIS MODEL
NOT USED TERMINALS:
X1:4, :41, :42, :44
WIRING:
55 75 90
A 25 35 50 mm²
B 25 35 35 mm²
C 25 35 35 mm²
D 2.5 2.5 2.5 mm²
E 1.5 1.5 1.5 mm²
Others 0.75 0.75 0.75 mm²
ENCODER
B6
M 3~

DYNAC V 110-160 F - N




DYNAC V 200-250 F - N
WIRING:
200 250
A 185 240 mm²
B 120 185 mm²
C 35 35 mm²
D 2.5 2.5 mm²
E 1.5 1.5 mm²
Others 0.75 0.75 mm²
FREE TERMINALS:
X1:19, :20, :21, :22, :23, :29, :30, :39, :40, :43, :60, :61, :62, :63, :68, :69, :70
IN THIS MODEL NOT USED TERMINALS:
X1:4, :41, :42, :44
A3
DYNABOARD
A2
ENCODER BOARD
A1
INVERTER BOARD
ENCODER
B6
T1
M 3~


DYNAC V 315 F - N
DYNABOARD
ENCODER BOARD
INVERTER BOARD

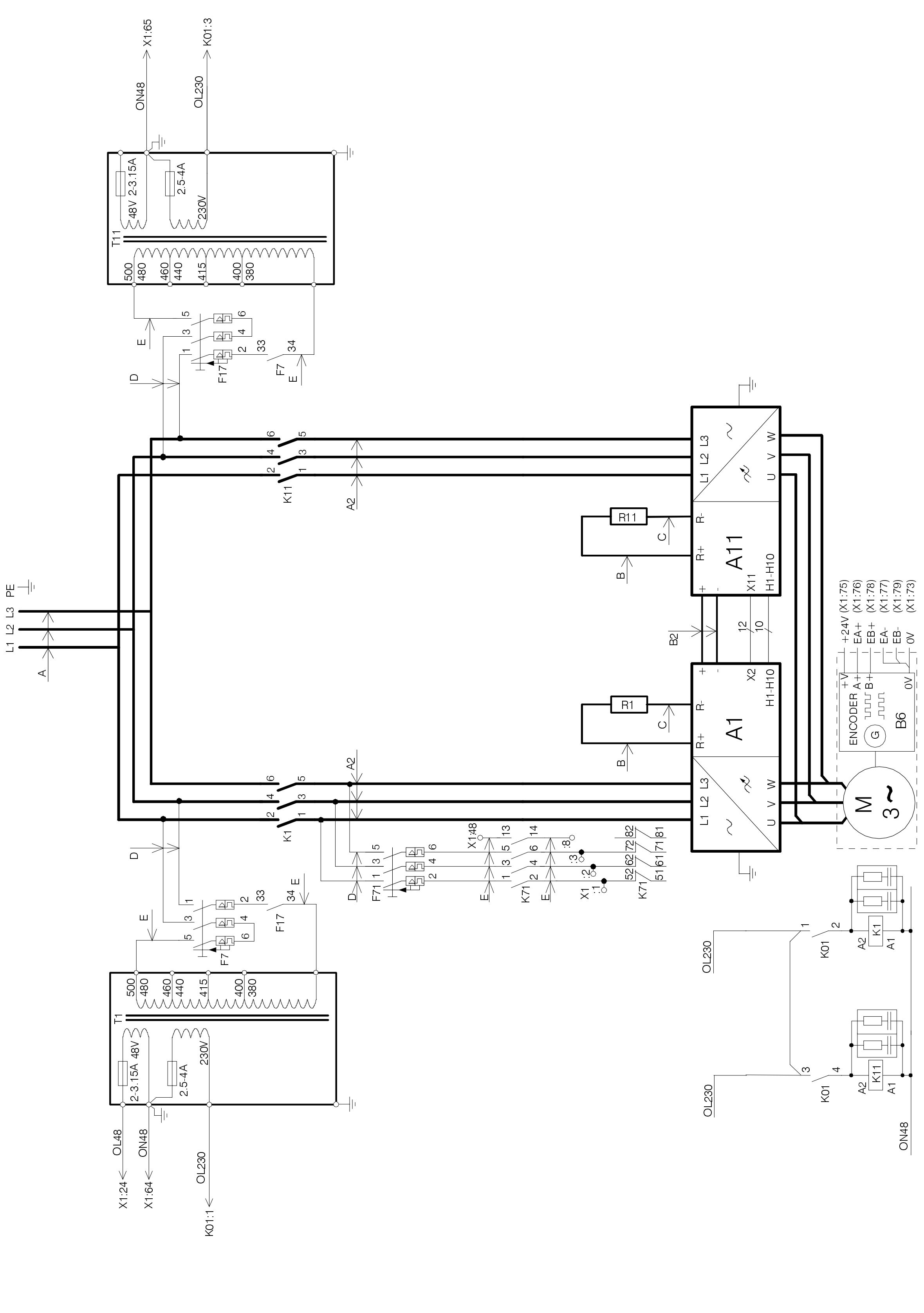

DYNAC V 400 F - N
A3
DYNABOARD
A2
ENCODER BOARD
A1
INVERTER BOARD
WIRING:

FREE TERMINALS:
X1:19, :20, :21, :22, :23, :29, :30, :39, :40, :43, :60, :61, :62, :63, :68, :69, :70

IN THIS MODEL
NOT USED TERMINALS:
X1:4, :41, :42, :44

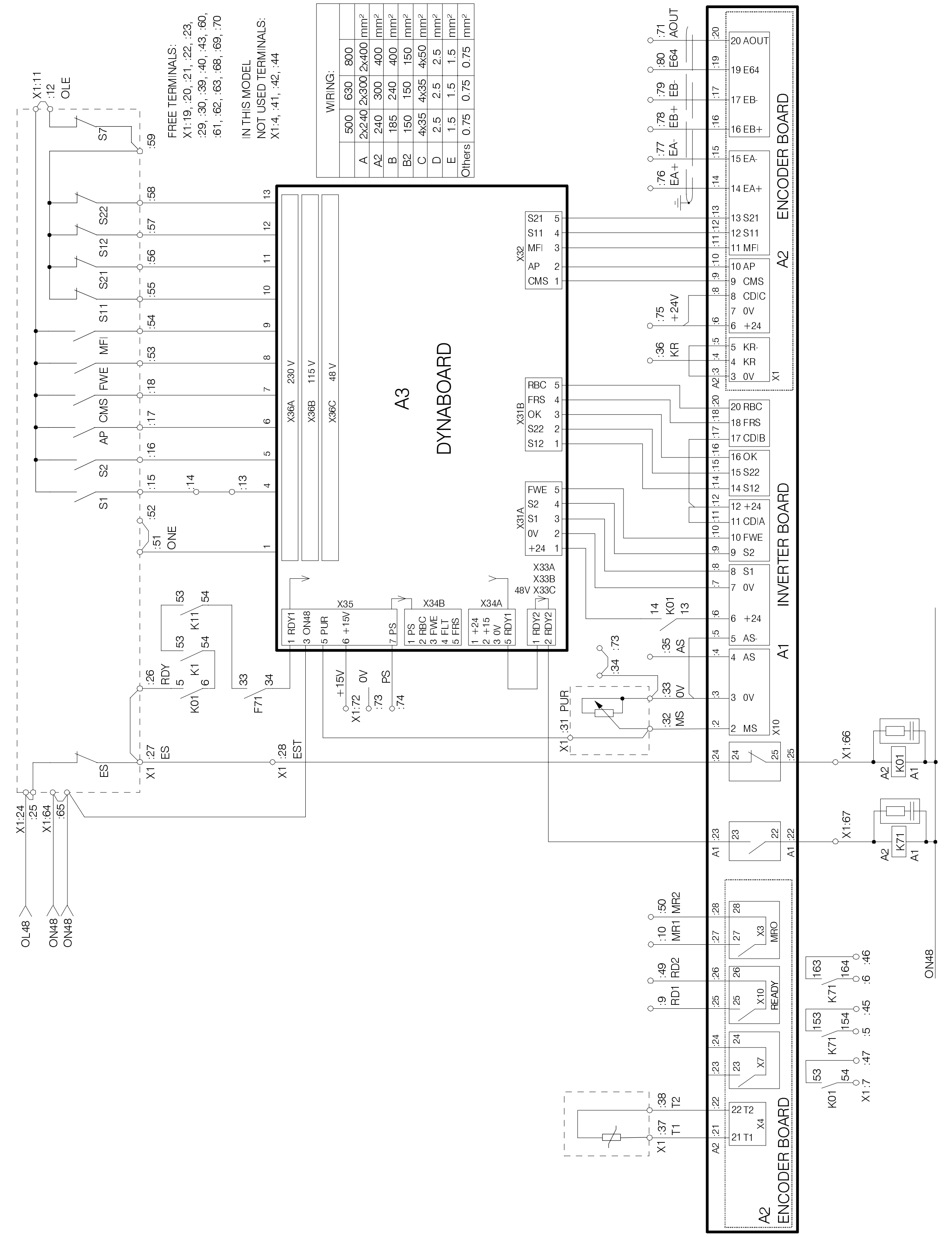
WIRING:

	500	630	800	
A	2x240	2x300	2x400	mm²
A2	240	300	400	mm²
B	185	240	400	mm²
B2	150	150	150	mm²
C	4x35	4x35	4x50	mm²
D	2.5	2.5	2.5	mm²
E	1.5	1.5	1.5	mm²
Others	0.75	0.75	0.75	mm²



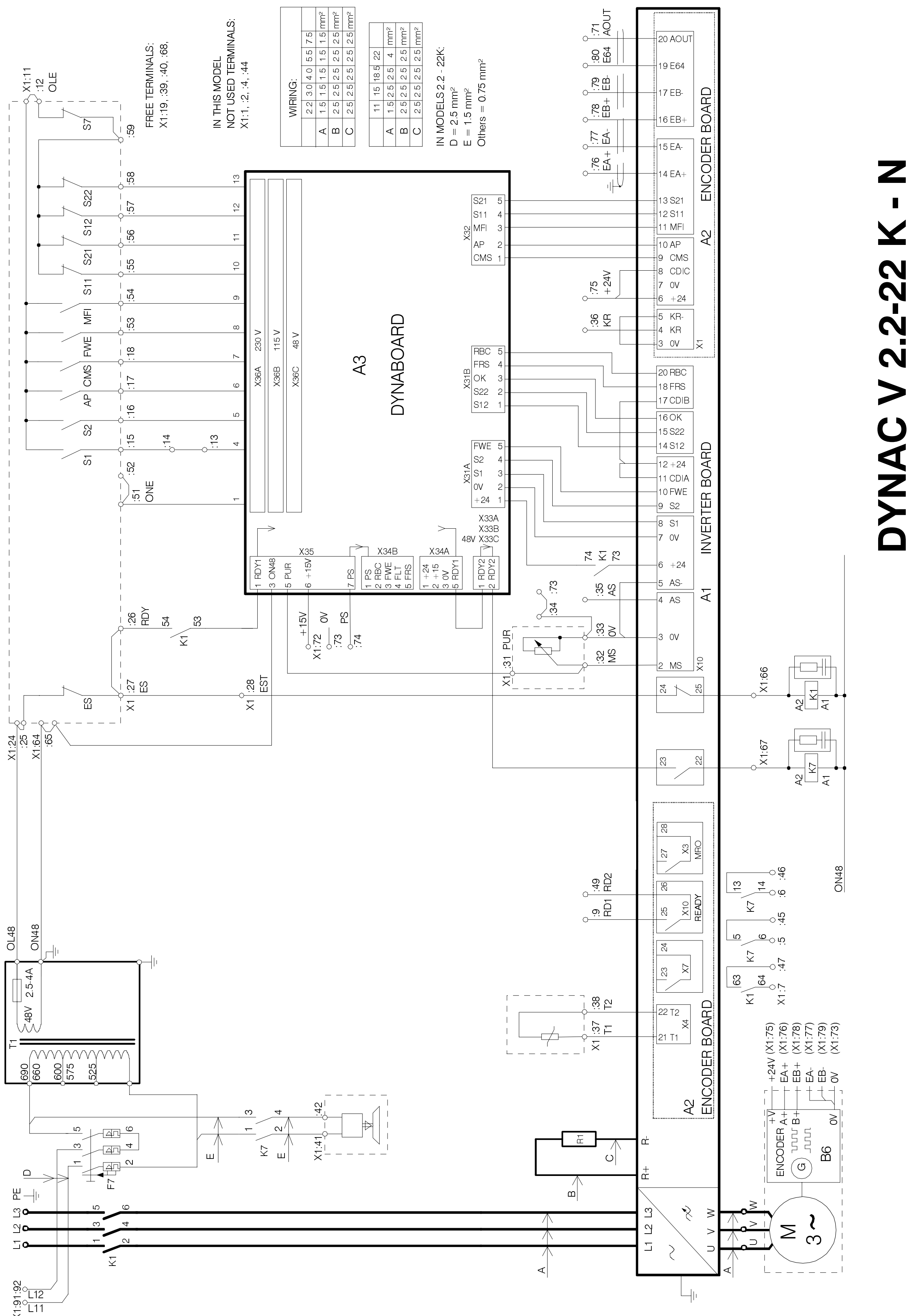
DYNAC V 500-800 F - N

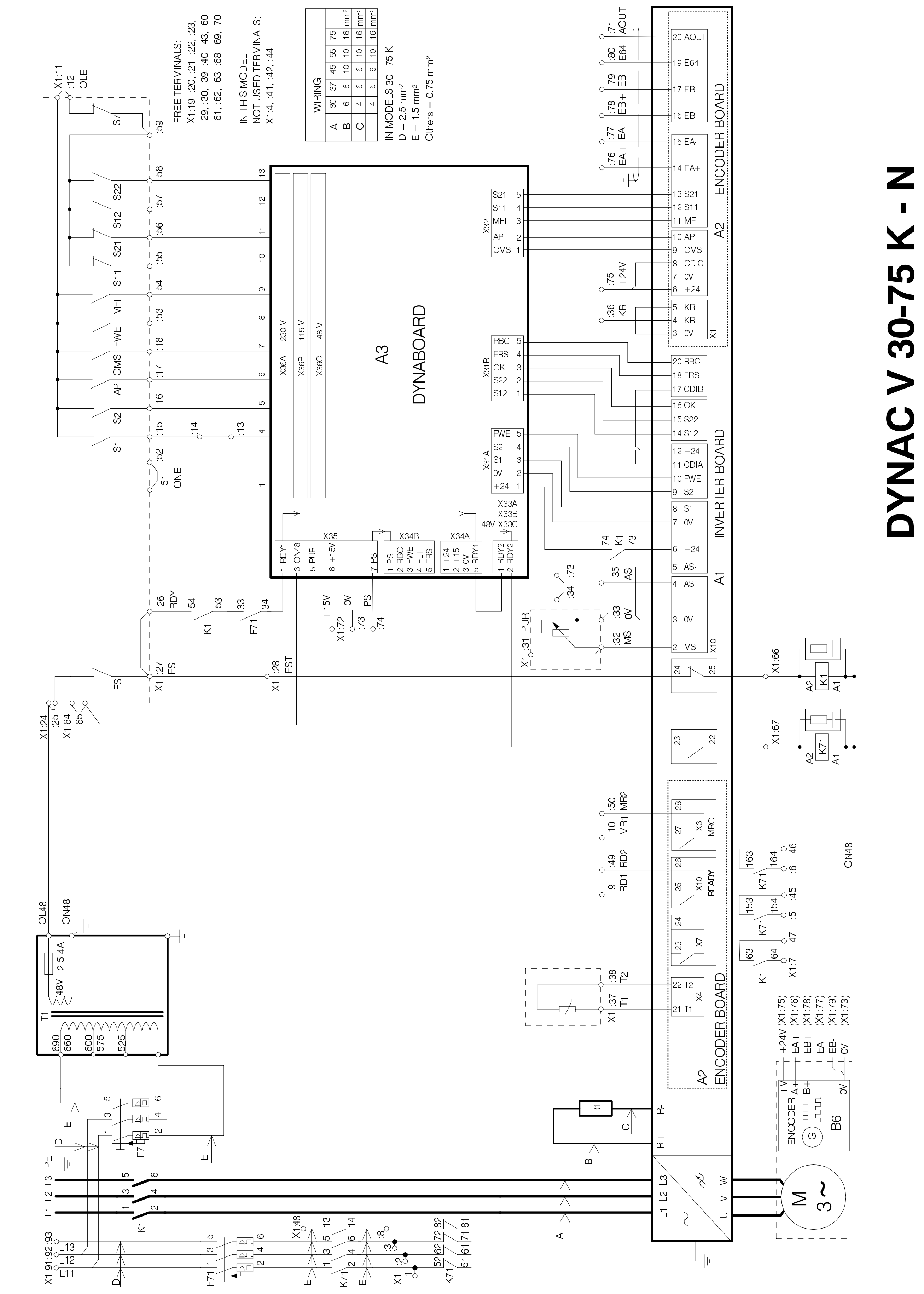
DYNAC V 500-800 F - N

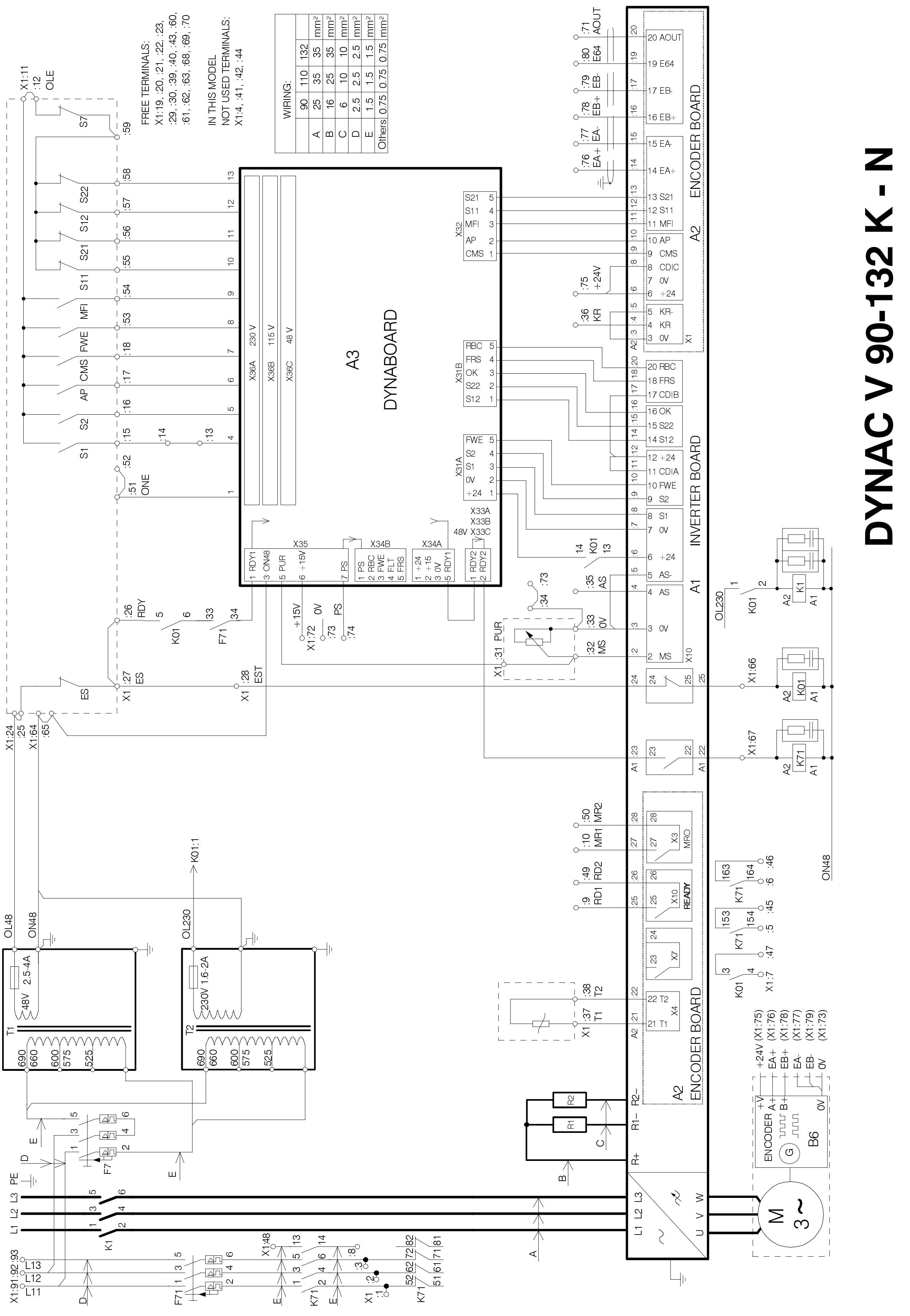


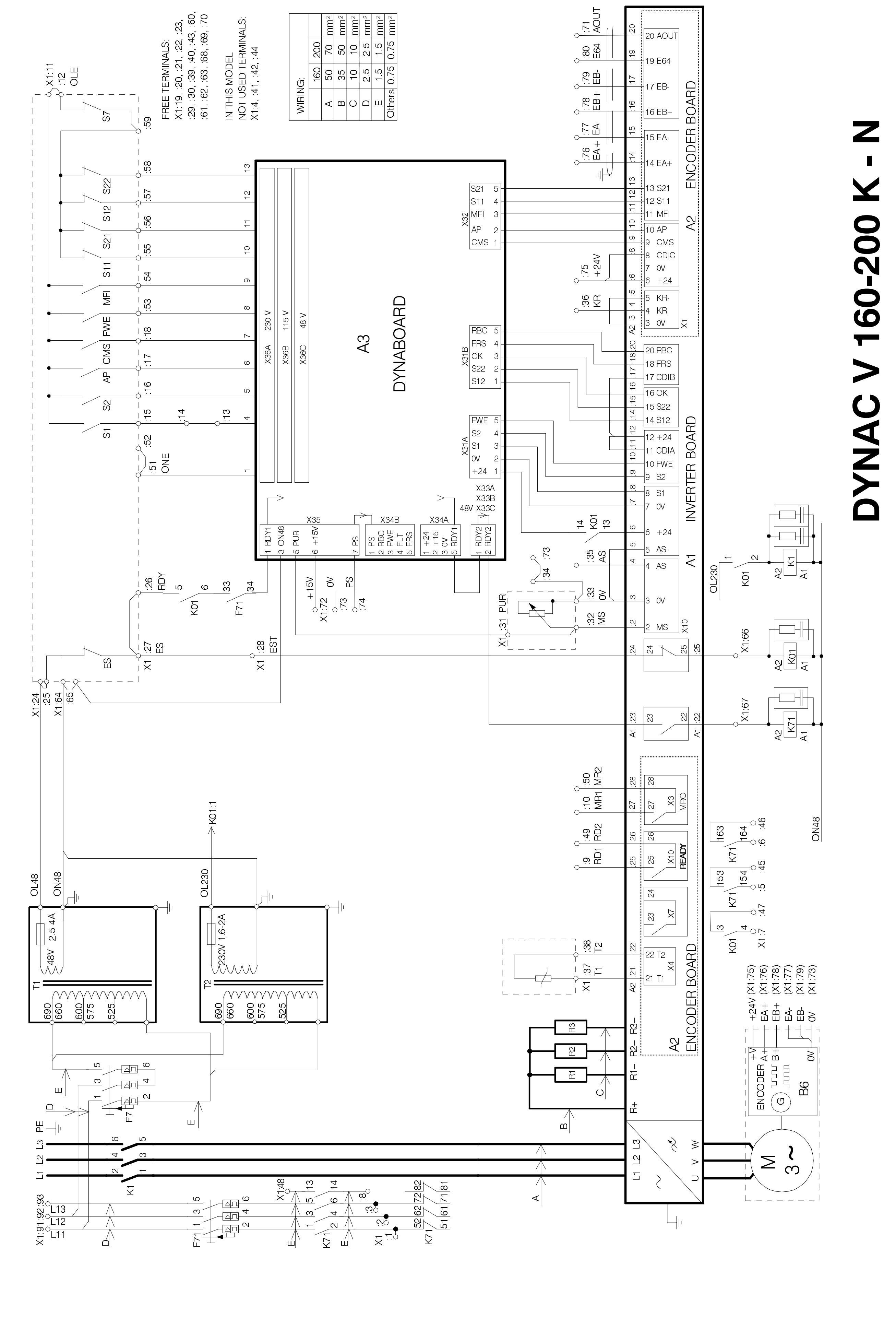
WIRING:

	500	630	800	
A	2x240	2x300	2x400	mm²
A2	240	300	400	mm²
B	185	240	400	mm²
B2	150	150	150	mm²
C	4x35	4x35	4x50	mm²
D	2.5	2.5	2.5	mm²
E	1.5	1.5	1.5	mm²
Others	0.75	0.75	0.75	mm²

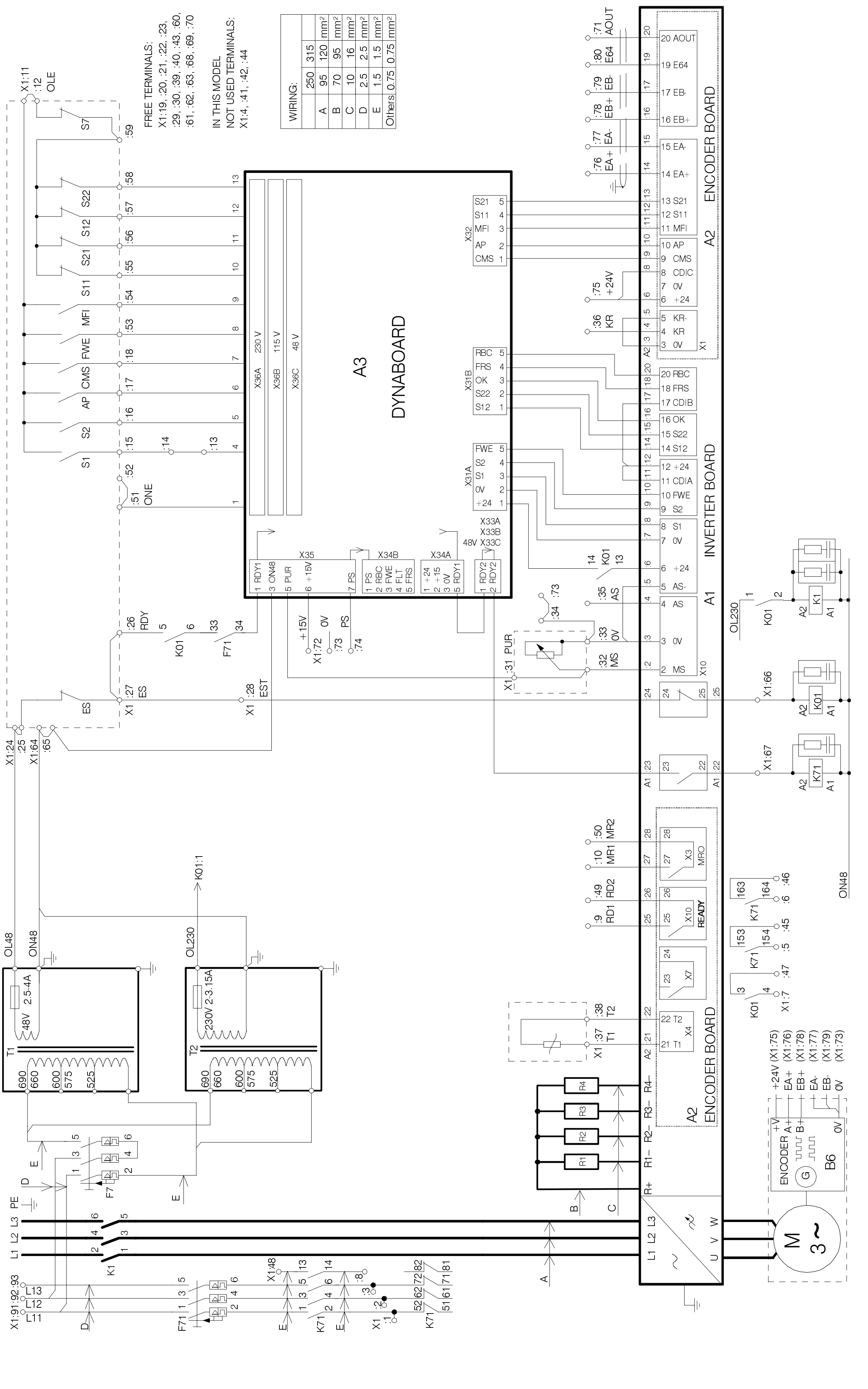

DYNAC V 2.2-22 K - N
A3
DYNABOARD
ENCODER BOARD
INVERTER BOARD
FREE TERMINALS:
X1:19, :39, :40, :68,
IN THIS MODEL
NOT USED TERMINALS:
X1:1, :2, :4, :44
WIRING:
IN MODELS 2.2 - 22K:
D = 2.5 mm²
E = 1.5 mm²
Others = 0.75 mm²

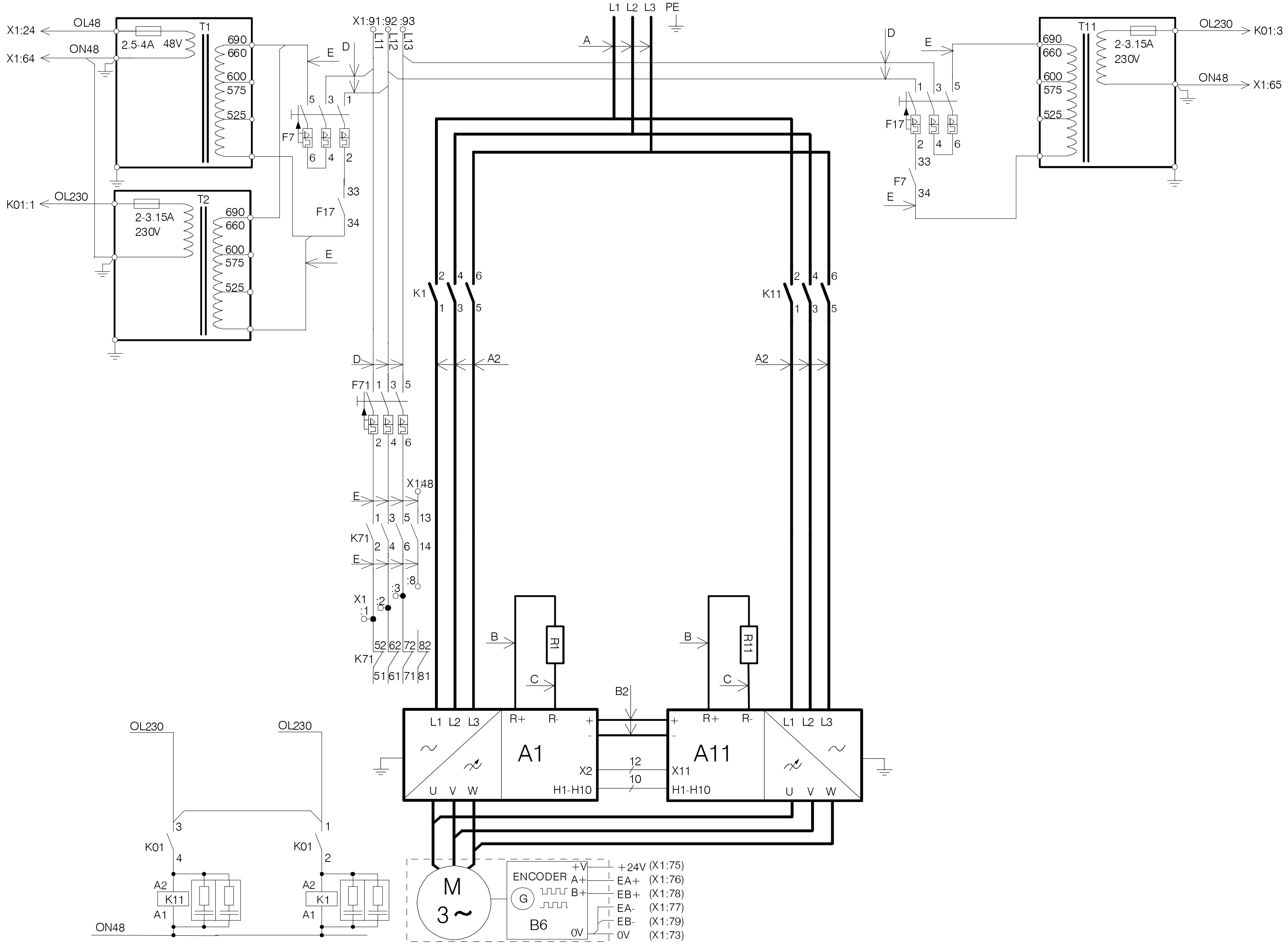

DYNAC V 30-75 K - N
A3
DYNABOARD
A2
ENCODER BOARD
A1
INVERTER BOARD
FREE TERMINALS:
X1:19, :20, :21, :22, :23,
:29, :30, :39, :40, :43, :60,
:61, :62, :63, :68, :69, :70
IN THIS MODEL
NOT USED TERMINALS:
X1:4, :41, :42, :44
WIRING:
IN MODELS 30 - 75 K:
D = 2.5 mm²
E = 1.5 mm²
Others = 0.75 mm²
ENCODER
B6
M
3~


DYNAC V 90-132 K - N
A3
DYNABOARD
A1
INVERTER BOARD
A2
ENCODER BOARD
FREE TERMINALS:
X1:19, :20, :21, :22, :23,
:29, :30, :39, :40, :43, :60,
:61, :62, :63, :68, :69, :70
IN THIS MODEL
NOT USED TERMINALS:
X1:4, :41, :42, :44
WIRING:
90 110 132
A 25 35 35 mm²
B 16 25 35 mm²
C 6 10 10 mm²
D 2.5 2.5 2.5 mm²
E 1.5 1.5 1.5 mm²
Others 0.75 0.75 0.75 mm²
ENCODER
B6


DYNAC V 160-200 K - N
A3
DYNABOARD
A2
ENCODER BOARD
A1
INVERTER BOARD
FREE TERMINALS:
X1:19, :20, :21, :22, :23, :29, :30, :39, :40, :43, :60, :61, :62, :63, :68, :69, :70
IN THIS MODEL NOT USED TERMINALS:
X1:4, :41, :42, :44
WIRING:
160 200
A 50 70 mm²
B 35 50 mm²
C 10 10 mm²
D 2.5 2.5 mm²
E 1.5 1.5 mm²
Others 0.75 0.75 mm²
ENCODER
B6
M 3~

DYNAC V 250-315 K - N





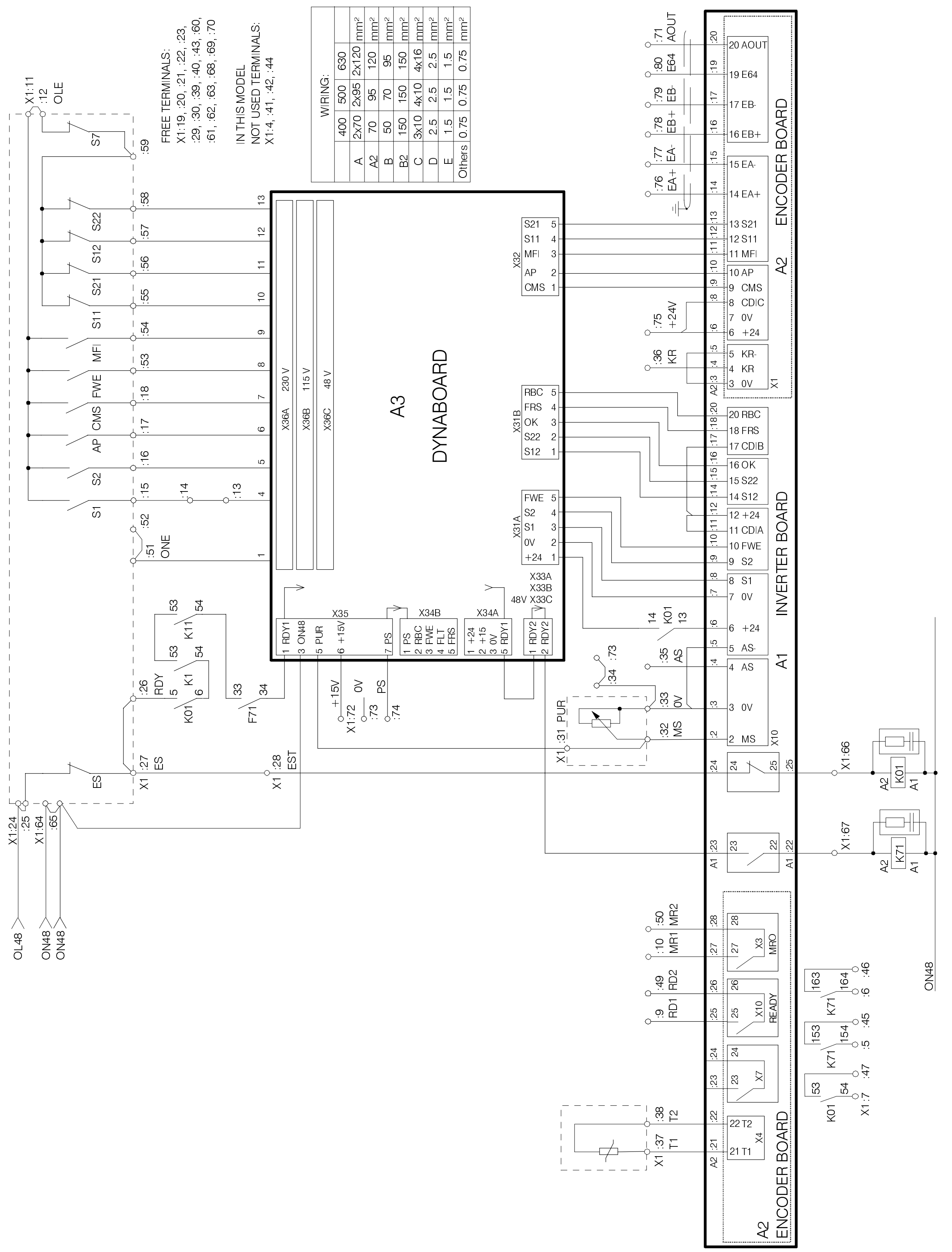
FREE TERMINALS:
X1:19, :20, :21, :22, :23,
:29, :30, :39, :40, :43, :60,
:61, :62, :63, :68, :69, :70

IN THIS MODEL
NOT USED TERMINALS:
X1:4, :41, :42, :44

WIRING:				
	400	500	630	
A	2x70	2x95	2x120	mm²
A2	70	95	120	mm²
B	50	70	95	mm²
B2	150	150	150	mm²
C	3x10	4x10	4x16	mm²
D	2.5	2.5	2.5	mm²
E	1.5	1.5	1.5	mm²
Others	0.75	0.75	0.75	mm²

DYNAC V 400-630 K - N

DYNAC V 400-630 K - N



FREE TERMINALS:
X1:19, :20, :21, :22, :23, :29, :30, :39, :40, :43, :60, :61, :62, :63, :68, :69, :70

IN THIS MODEL
NOT USED TERMINALS:
X1:4, :41, :42, :44

WIRING:

	400	500	630	
A	2x70	2x95	2x120	mm²
A2	70	95	120	mm²
B	50	70	95	mm²
B2	150	150	150	mm²
C	3x10	4x10	4x16	mm²
D	2.5	2.5	2.5	mm²
E	1.5	1.5	1.5	mm²
Others	0.75	0.75	0.75	mm²

Appendix A21 Commission table

KONECRANES DYNAC Vector

COMMISSIONING TABLE

Serial number : ____________________

Type : DynAC V ____________________

CHECK DATA:	O K	Remarks:
External wires and terminals	☐	____________________
Protective devices	☐	____________________
Isolation resistance (max. testing voltage 500V)	☐	____________________
Voltage selection	☐	Value: ____________________
Limit switches	☐	____________________
Speed reference	☐	____________________
Parameters checked (according to parameter list)	☐	____________________
Motor	☐	Type: ____________________

Extended speed range option ☐ No ☐ Yes ESR load limit ________ %

ESR fmax: ________ Hz

Motor speed sensor ☐ Pulse encoder Pulses per revolution: ________

Remarks : ____

____

Date : ________________ Checked by : ____________________