VACON® NX

AC DRIVES

ACTIVE FRONT END II (AFE-II)

ARFIFF05

APPLICATION MANUAL

VACON®

Vacon Standard AFE-II application

INDEX

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1. INTRODUCTION

The AFE unit is a regenerative power converter for the front-end of a common DC bus product line.
The AFE unit is utilized by using inverter hardware with special software. An external L(CL)-filter and charging circuit is needed. This unit is selected when low harmonics are required. The principle connection of AFE drive has been described in Figure 1.

The Regenerative Application is easy and flexible to use due to its versatile fieldbus features. The parameters of the Regenerative Application are explained in Chapter 6 of this manual.

The basic I/O-configuration of the AFE drive consists of OPT-A1 and OPT-A2 option cards. The basic I/O configuration has been described in table 2-1.
As a default the control place (P3.1) of the AFE drive is Keypad.

This application requires NXP3 control board VB00761.

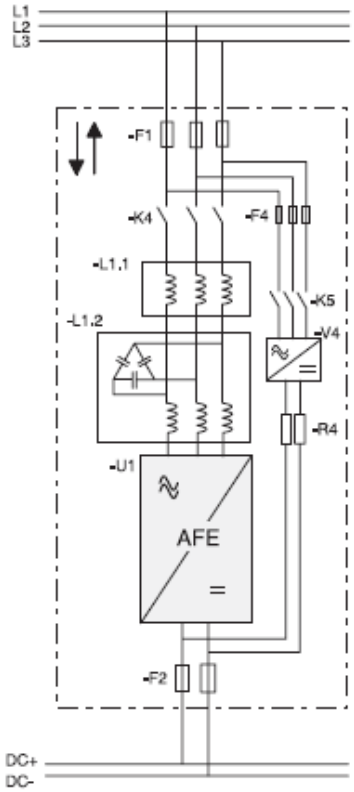


Figure 1, AFE connection

1.1 COMPATIBILITY ISSUES IN PARAMETERS BETWEEN VERSIONS

V025

- **Compatibility Issue:** MCB Force Open inverted. This to follow NXC cabinet default signals.

Update Note 1: This application parameters are not kept backwards compatible if new features or improvements would be difficult to implement by doing so. Read this change note and chapter "Compatibility issues in parameters between versions" from manual before updating the application.

Update Note 2: It's recommended to use compare function for parameter changes when updating application, especially in cases when version number change is considerably high.
Application is constantly developed; this includes changing parameter default values, and if parameters are directly downloaded to drive improved default values may be lost.

2. OPERATION

2.2 CHARGING OF DC

This AFE application has own charging control, P2.4.1.9 DC Charge (24 Vdc required for control board) and charging protection in case external charging can't get DC voltage to required level within set time P2.7.1.5 Charge Max Time (provided that DC Voltage reach at least drive under voltage fault level).

Charging function is activated when P2.4.1.9 DC Charge is A.1 or higher. When control place is IO, Keypad or NCDrive charging is started from start command.
Charging is not started if:

- Drive is in fault state.
- P2.3.1.2 Enable MCB Close is FALSE
- P2.3.1.6 Run Enable is FALSE
- P2.3.1.7 Quick Stop is FALSE

Charging is also stopped if above conditions happens during charging or start command is removed.

For fieldbus control charging is started with B0 of FB Control Word on supporting FB profiles. Charging is also stopped if B0 goes low as is MCB opened if already closed.

DC Charge (F80) is given if 85 % of DC Nominal is not reached within P2.7.1.5 Charge Max Time and charging is stopped.

DC Charging is stopped when drive receives feedback from P2.3.1.5 MCB Status.

Note! Use suitably sized DC Charging resistor by checking Pulse loadability for time duration set in for Max Charge Time parameter

NOTE! The MCB feedback is necessary for the correct operation of the AFE application.

NOTE! Only the drive controls its own MCB. If additional interlocks or opening commands are needed, these commands must go through the drive.

NOTE! Missing feedback signal prevent drive going to ready state. MCB Feedback can be monitored from Status Word B10.

NOTE! If feedback is not used there will be three second forced delay on internally generated MCB feedback signal. MCB Feedback can be monitored from Status Word B10.

2.3 MAIN CIRCUIT BREAKER CONTROL (MCB CONTROL)

The AFE application controls the MCB of the system with Relay Output RO2. When charging of the DC bus is ready the MCB will be closed. The status of the MCB is monitored via digital input P2.3.1.5 MCB Status (Default is DigIn: A.4). MCB feedback is required for correct AFE functionality,

NOTE! MCB feedback is required for correct AFE functionality.

Over Current (F1), Hardware IGBT (F31) and Software IGBT (F41) faults will open MCB immediately. Some fault can be programmed to open MCB if needed.

NOTE! For correct operation of AFE system, AFE unit needs to be in control of charging circuit and Main Circuit Breaker (MCB).

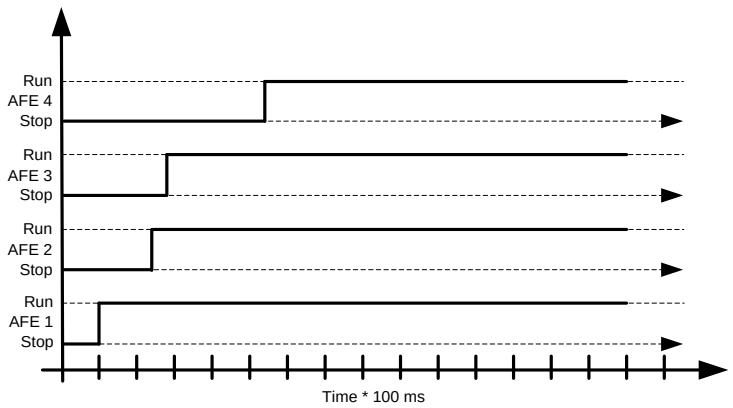
2.4 QUICK START INSTRUCTIONS

NOTE! Before taking any commissioning actions read carefully the safety instructions in Vacon NX User's Manual, chapter 1.

1. Connect the unit according to the Figure 1.
2. Power up the control unit.
3. Set parameters in G2.1 Basic Parameters.
4. Check that digital input parameters (G2.3.1) have been set according to connections. **Note** that P2.3.1.5 MCB Status input is needed for correct operation of AFE unit.
5. Check the control place accordingly proves requirements (P3.1 Control Place).
6. Charge DC.

In case of parallel AFE:

1. Set Parallel AFE parameter (P2.1.5) = **YES** (in every AFE). (This will set also DC Drooping to 3,00 %
2. Set Start Up Delay in AFE units so that starting is in sequence with different intervals.



2.5 START SEQUENCE

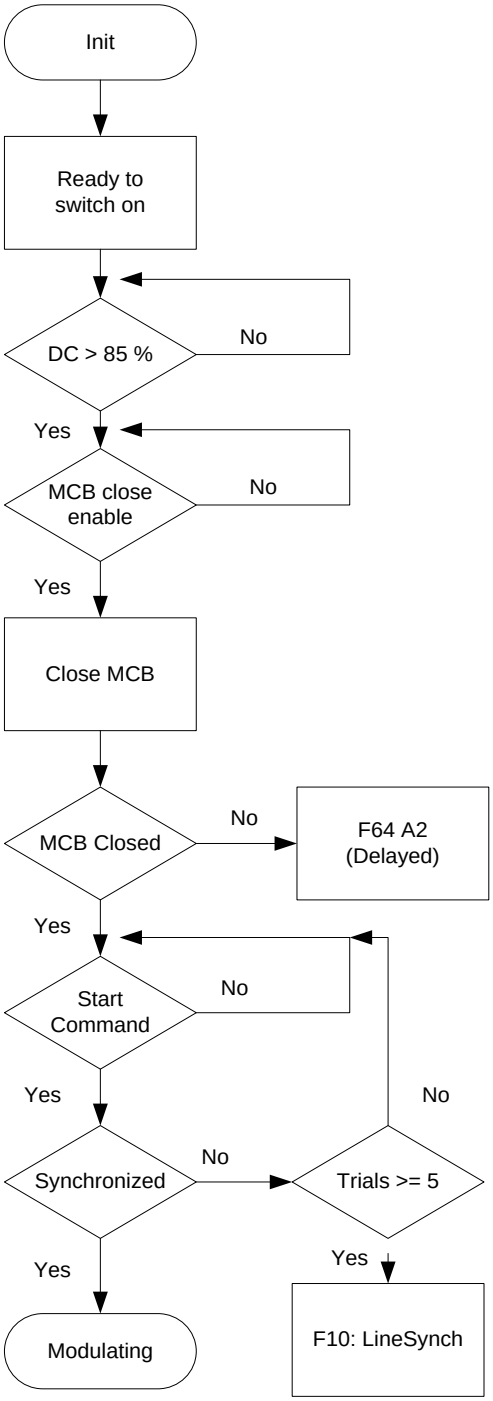


Figure 0-2. AFE start sequence

2.6 STOP SEQUENCE

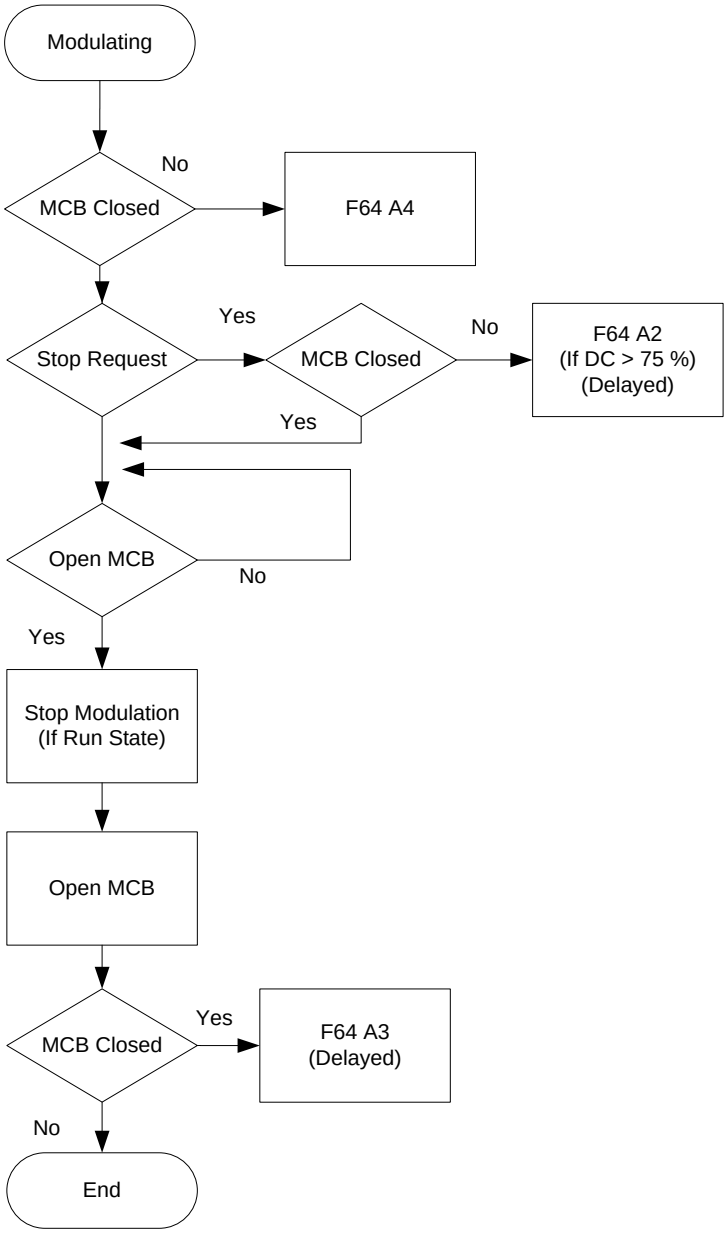
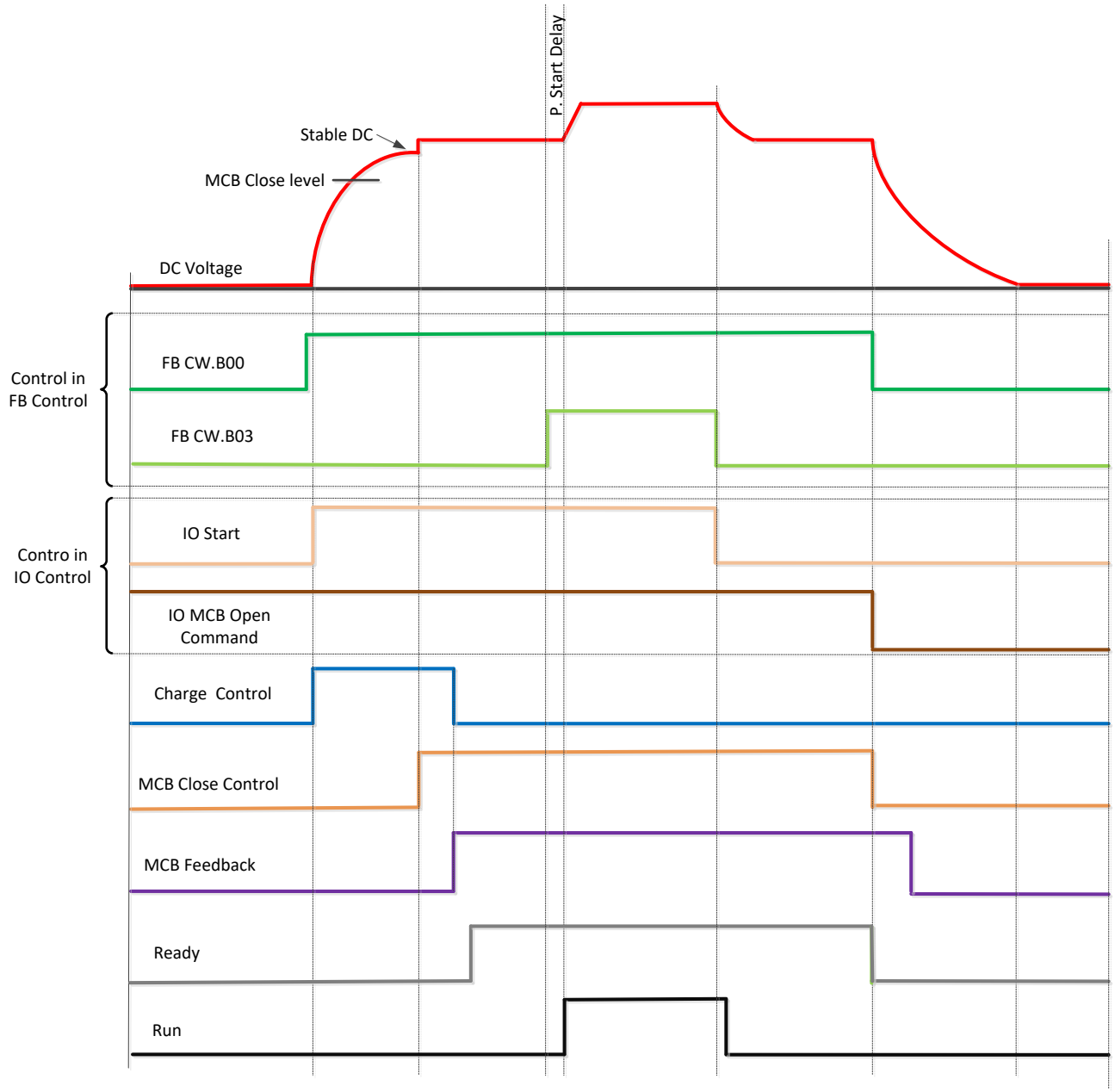


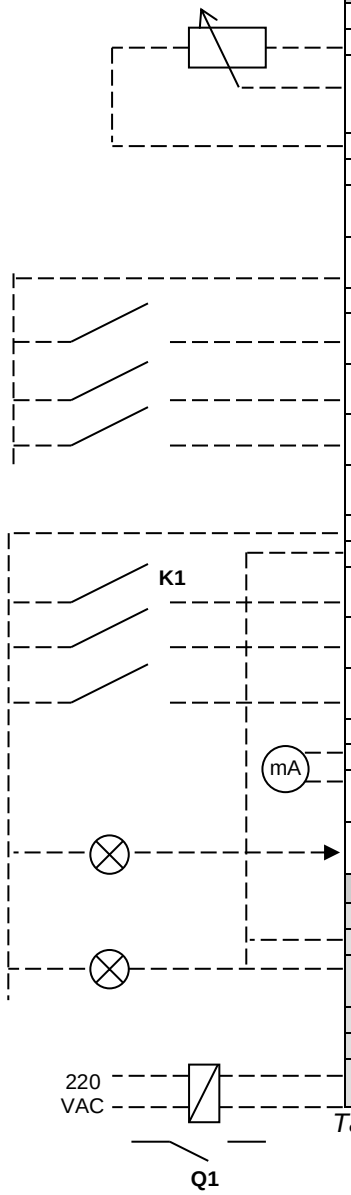
Figure 0-3. AFE stop sequence

2.7 START STOP TIMING DIAGRAM



Above example when “Standard” state machine is used. With “Basic” state machine operation is like in IO Control.

3. CONTROL I/O



NXOPTA1			
Terminal		Signal	Description
1	+10V$_{ref}$	Reference voltage output	Voltage for potentiometer, etc.
2	AI1+	Analogue input 1. Range 0-10V, R_i = 200Ω Range 0-20 mA R_i = 250Ω	Analogue input 1 Input range selected by jumpers. Default range: Voltage 0 – 10 V
3	AI1-	I/O Ground	Ground for reference and controls
4	AI2+	Analogue input 2.	Analogue input 2
5	AI2-	Range 0-10V, R_i = 200Ω Range 0-20 mA R_i = 250Ω	Input range selected by jumpers. Default range: Current 0 – 20 mA
6	+24V	Control voltage output	Voltage for switches, etc. max 0.1 A
7	GND	I/O ground	Ground for reference and controls
8	DIN1	Start Request Programmable G2.3.1	Contact closed = Start Request
9	DIN2	Programmable G2.3.1	No function defined at default
10	DIN3	Fault Reset Programmable G2.3.1	Contact closed = Fault Reset
11	CMA	Common for DIN 1—DIN 3	Connect to GND or +24V
12	+24V	Control voltage output	Voltage for switches (see #6)
13	GND	I/O ground	Ground for reference and controls
14	DIN4	MCB feedback	Contact open = MCB open Contact closed = MCB Closed
15	DIN5	Programmable G2.3.1	No function defined at default
16	DIN6	Programmable G2.2.1	
17	CMB	Common for DIN4—DIN6	Connect to GND or +24V
18	AOA1+	Analogue output 1	Output range selected by jumpers.
19	AOA1-	Programmable P2.3.1.2	Range 0—20 mA. R_L, max. 500Ω Range 0—10 V. R_L > 1kΩ
20	DOA1	Digital output Ready / Warning (Blinking)	Programmable Open collector, I≤50mA, U≤48 VDC
NXOPTA2			
21	RO1	RELAY OUTPUT 1	Switching capacity 24 VCD / 8 A 250 VAC / 8 A 125 VDC / 0.4 A
22	RO1		
23	RO1	Programmable G2.4.1	
24	RO2	Relay output 2	Fixed to MCB control.
25	RO2	MCB Contl	Closes when DC at 85 % of nominal DC.
26	RO2	Cannot be reprogrammed	Opens when DC below 75 % of nominal DC

Table 4-2. Default I/O configuration.

4. AFE APPLICATION – MONITORING VALUES

On the next pages you will find the lists of parameters within the respective parameter groups.

Column explanations:

Code = Location indication on the keypad; Shows the operator the present parameter number
Parameter = Name of parameter
Min = Minimum value of parameter
Max = Maximum value of parameter
Unit = Unit of parameter value; Given if available
Default = Value preset by factory
Cust = Customer's own setting
ID = ID number of the parameter
= On parameter code: Parameter value can only be changed after the Drive has been stopped.
= Monitoring value is possible to control from fieldbus by ID number

The manual presents signals that are not normally visible for monitoring. i.e. is not a parameter or standard monitoring signal. These signals are presented with [Letter]. e.g. [FW]MotorRegulatorStatus

[V] Normal monitoring signal
[P] Normal parameter in application.
[FW] Firmware signal, Can be monitored with NCDrive when signal type is selected Firmware
[A] Application signal, can be monitored with NCDrive when signal type is selected Application.
[R] Reference type parameter on keypad.
[F] Function. Signal is received as a output of function.
[DI] Digital input signal.
CB Circuit Breaker
MCB Main Circuit Breaker = AFE controller Circuit Breaker

5.1 MONITORING VALUES

The monitoring values are the actual values of parameters and signals as well as statuses and measurements. Monitoring values cannot be edited.

5.1.1 MONITORING 1

Code	Signal	Unit	ID	Description
V1.1.1	DC-Link Voltage	Vdc	1108	Measured DC Link voltage in Volts, filtered.
V1.1.2	DC-Link Ref.	Vdc	25	DC Voltage Reference in Vdc
V1.1.3	DC Voltage Ref.	%	1200	Used DC Voltage Reference
V1.1.4	DC Voltage Act.	%	7	Actual DC Voltage
V1.1.5	Total Current	A	3	Total current of the regenerative unit in Amperes.
V1.1.6	Active Current	%	1125	Avtive current of the regenerative drive in % of Rated Line Current. > 0 power from AC side to DC side < 0 power from DC side to AC side
V1.1.7	Reactive Current	%	1157	Reactive current of the regenerative drive in % of Rated Line Current. > 0 Inductive current < 0 Capacitive current
V1.1.8	Supply Frequency	Hz	1	Supply frequency in ##.## Hz .The sign indicates the phase order.
V1.1.9	Supply Voltage	V	6	Input AC voltage, RMS line to line Volts.
V1.1.10	Unit Temperature	°C	8	Heat sing temperature
V1.1.11	Status Word		43	
V1.1.12	DIN 645. 321		15	
V1.1.13	Analogue Input 1	%	13	
V1.1.14	Analogue Input 2	%	14	
V1.1.15	Analogue Out 1	%	26	
V1.1.16	Operation Hours	h	1856	
V1.1.17	DC-Link Current	A	72	
V1.1.18	DC-Link ActCurr	%	1158	

5.1.2 FIELDBUS MONITORING VALUES

Code	Signal	Unit	ID	Description
V1.2.1	FB Control Word		1160	Control word from fieldbus
V1.2.2	FB Status Word		68	Status word to fieldbus
V1.2.3	Fault Word 1		1172	
V1.2.4	Fault Word 2		1173	
V1.2.5	DIN Status Word 1		56	
V1.2.6	DIN Status Word 2		57	
V1.2.7	Warning Word 1		1174	
V1.2.8	DC Voltage		44	Unfiltered DC-Link voltage
V1.2.9	Current		1113	Unfiltered total current
V1.2.10	Drive Power	kW	1508	Electrical AFE terminal power
V1.2.11	Fault History		37	
V1.2.12	Final DC Ref	%	1131	
V1.2.13	Cabin State Word		1884	
V1.2.14	Warning		74	

5.1.3 LINE MONITOR OPT-D7

Code	Signal	Unit	ID	Description
V1.3.1	Line Voltage	V	1650	
V1.3.2	Line Frequency	Hz	1654	
V1.3.3	Synch Error D7		1659	
V1.3.4	Line Voltage THD		1670	
V1.3.5	Line Voltage HF rms		1671	

5.1.4 MASTER FOLLOWER

Code	Parameter	Unit	Form.	ID	Description
V1.4.1	SB SystemStatus			1601	
V1.4.2	Master CW			93	
Code	**Parameter**	**Unit**		**ID**	**Description**
V1.4.3.1	Current D1	A	Varies	1820	
V1.4.3.2	Current D2	A	Varies	1821	
V1.4.3.3	Current D3	A	Varies	1822	
V1.4.3.4	Current D4	A	Varies	1823	
Code	**Parameter**	**Unit**		**ID**	**Description**
V1.4.4.1	Status Word D1		#	1828	
V1.4.4.2	Status Word D2		#	1829	
V1.4.4.3	Status Word D3		#	1830	
V1.4.4.4	Status Word D4		#	1831	

5.1.5 MONITORING VALUES 2

Code	Signal	Unit	ID	Description
V1.5.1	Measured temperature 1	Cº	50	4 s filtering.
V1.5.2	Measured temperature 2	Cº	51	4 s filtering.
V1.5.3	Measured temperature 3	Cº	52	4 s filtering.
V1.5.4	Measured temperature 4	Cº	69	4 s filtering.
V1.5.5	Measured temperature 5	Cº	70	4 s filtering.
V1.5.6	Measured temperature 6	Cº	71	4 s filtering.
V.1.5.7	PT-100 Temperature	Cº	42	Highest temperature of OPTB8/OPTBH board. 4 s filtering.

4.7.1 PID CONTROL

Code	Parameter	Unit	Form.	ID	Description
V1.6.1	PID Reference		#,#	20	
V1.6.2	PID Actual Value		#,#	21	
V1.6.3	PID Output		#,##	23	

5.2 MONITORING VALUES DESCRIPTION

5.2.1 MONITORING 1 VALUES

V1.1.1 DC-Link Voltage Vdc ID44

Measured DC voltage, filtered.

V1.1.2 DC-Link Ref. Vdc ID25

DC-Link voltage reference in Vdc.

V1.1.3 DC Voltage Ref. % ID1200

Used DC Voltage reference in %

V1.1.4 DC Voltage Act. % ID7

Actual DC Voltage in %

V1.1.5 Total Current A ID3

Total current of the regenerative unit in Amperes, filtered

V1.1.6 Active Current % ID1125

Active current in % of System Rated Current.
Negative value means that current is flowing to AC side from DC side i.e. regenerating.

V1.1.7 Reactive Current % ID1157

Reactive current of the regenerative drive in % of System Rated Current.
Positive is Inductive current.
Negative is capacitive current.

V1.1.8 Supply Frequency Hz ID1

Supply frequency in ##.## Hz .The sign indicates the phase order. Updated when drive in run state. Updated also in stop state when OPT-D7 is used or Regen Options B9 is activated.

V1.1.9 Supply Voltage V ID6

Input AC voltage, RMS line to line Volts. Updated when drive in run state.
Updates also when OPT-D7 is used.

V1.1.10 Unit Temperature °C ID8

Temperature of the unit in degrees Celsius

V1.1.11 Status Word ID43

Application Status Word combines different drive statuses to one data word.

	Application Status Word ID43	
	FALSE	TRUE
b0		
b1	Not in Ready state	Ready
b2	Not Running	Running
b3	No Fault	Fault
b4		
b5	Quick Stop Active	Quick Stop Not Active
b6	Run Disabled	Run Enable
b7	No Warning	Warning
b8		Charging Switch closed (internal)
b9		MCB Control (DO Final)
b10		MCB Feedback
b11		DO Charging Active
b12	No Run Request	Run Request
b13		
b14		
b15		

V1.1.12 DIN 645. 321 ID15

	DIN1/DIN2/DIN3 status
B0	DIN1
B1	DIN2
B2	DIN3
B3	DIN4
B4	DIN5
B5	DIN6

V1.1.13 Analogue Input 1 % ID13

V1.1.14 Analogue Input 2 % ID14

Unfiltered analogue input level.
0 % = 0 mA / 0 V, -100 % = -10 V, 100 % = 20 mA / 10 V.
Monitoring scaling is determined by the option board parameter.

V1.1.15 Analogue Out 1 % ID26

Analogue Output value 0 % = 0 mA / 0 V, 100 % = 20 mA / 10 V

V1.1.16 Operation HoursID1856

Run state hours

V1.1.17 DC-Link Current [A] ID72

Calculated DC-Link Current in Amps.

V1.1.18 DC-Link ActCurr [%] #,# ID1158

Calculated DC-Link Current in %.

5.2.2 FIELDBUS MONITORING VALUES

V1.2.1 FB Control Word ID 1160

Control word from fieldbus. Below table is for bypass operation for such fieldbus board that natively supports this or can be parameterized to bypass mode.

	FB Control Word ID1160		
	Signal	Comment	SM
B00	DC Charge	**0**= Open MCB. **1**= Close DC charge contactor, MCB closed automatically, see B01.	1,2,3
B01	MCB Close Enable	**0**= Disable Closing of MCB (Also opens if Control Options.B0=TRUE) **1**= Enable Closing of MCB (Works also for reclosing)	3
B02	Quick Stop	**0**= Quick Stop **1**= No Quick Stop	3
B03	Run	**0**= AFE is stopped **1**= AFE is started	1,2,3
B04	Output Power Limit to Zero	**0**= Output Power Limit to Zero (7%) **1**= Output Power Limit = P2.5.2.1	3
B05	Disable Power Increase. Input or Output	**0**= Disable increase of power. **1**= Power limits defined by G2.5.2	3
B06	Input Power Limit to Zero	**0**= Input Power Limit to Zero (7%) **1**= Output Power Limit = P2.5.2.2	3
B07	Reset	0>1 Reset fault.	1,2,3
B08	DC Voltage Ref B00	B00 | B01	2,3
B09	DC Voltage Ref B01	**0 | 0** = FB Reference. P2.2.1, if not FB Control & FB Ref > 50,00 % **0 | 1** = 110 % **1 | 0** = 115 % **1 | 1** = 120 %	2,3
B10	Fieldbus Control	**0**= No control from fieldbus **1**=Control from fieldbus	2,3
B11	Watchdog	0>1>0>1…0,5 sec square wave clock. This is used to check data communication between fieldbus master and the drive.	2,3
B12	FB DIN2	Can be used to control RO or directly parameter by ID number. G2.4.1	1,2,3
B13	FB DIN3	Can be used to control RO or directly parameter by ID number. G2.4.1	1,2,3
B14	FB DIN4	Can be used to control RO or directly parameter by ID number. G2.4.1	1,2,3
B15		Reserved for future use.	

V1.2.2 FB Status Word ID 68

FB Status word to fieldbus. Below table is for bypass operation for such fieldbus board that natively supports this or can be parameterized to bypass mode.

	FB Status Word ID68	
	Signal	Comment
b0	Ready On	0=Drive not ready to switch on 1=Drive ready to start charging
b1	Ready Run	0=Drive not ready to run 1=Drive ready and MCB is ON
b2	Running	0=Drive not running 1=Drive in Run state (Modulating)
b3	Fault	0=No active fault 1=Fault is active
b4	Run Enable Status	0= Run Disabled. Drive in stop state 1= Run Enabled. Drive can be started.
b5	Quick Stop Active	0=Quick Stop Active 1=Quick Stop not Active
b6	MCB Control NOT OK	0= MCB Control OK 1= MCB Requested open but DC stays high
b7	Warning	0= No active warnings 1= Warning active
b8	At Reference	0= DC Voltage Ref and Act DC Voltage are not same.
b9	Fieldbus Control Active	0=Fieldbus control not active 1=Fieldbus control active
b10	Above Limit	0= DC Voltage is below P2.5.5.1 level 1=The DC Voltage is above the P2.5.5.1 level
b11	MCB Control (DO Final)	0= Drive is controlling MCB to be Open. 1= Drive is controlling MCB to be Closed
b12	MCB Feedback	0= Feedback indicates MCB to be Open 1= Feedback indicates MCB to be Closed
b13		Reserved for future use.
b14	DC Charge DO Control	0= DC not charged 1= DC Charging Active
b15	Watchdog	Same as received on bit 11 of the FB Control Word.

V1.2.3 Fault Word 1 ID 1172

	Fault Word 1 ID1172
Bit	Fault(s)
B0	F1 Over current, F31 IGBT, F41 IGBT
B1	F2 Over Voltage
B2	F9 Under Voltage
B3	F91 Short Circuit
B4	F3 Earth Fault
B5	
B6	F14 Unit Over Temperature
B7	F29 Thermistor, F56 Measured Temperature 1, F65 Measured Temperature 2 F71 LCL Over Temperature
B8	F10 Line Synch fault F11 Supply Phase
B9	
B10	Device faults: F37, F38, F39, F40
B11	
B12	
B13	
B14	
B15	

V1.2.4 Fault Word 2 ID 1173

	Fault Word 2 ID1173
Bit	Fault(s)
B0	
B1	F5 Charging Fault, F80 Charge Fault
B2	
B3	Hardware faults: F7
B4	F13 Under Temperature
B5	F22 EPROM, F49 Zero Division
B6	
B7	
B8	
B9	F31 IGBT, F41 IGBT
B10	
B11	F32 Fan Fault, F70 LCL Fan Fault, F60 LC Cooling Warning/Fault
B12	
B13	F8 System, F26 Start Up Prevented, F36 Control Unit
B14	F64 MCB State Fault
B15	

V1.2.5 DIN Status 1 ID 56

V1.2.6 DIN Status 2 ID 57

	DIN Status Word 1	DIN Status Word 2
b0	DIN: A.1	DIN: C.5
b1	DIN: A.2	DIN: C.6
b2	DIN: A.3	DIN: D.1
b3	DIN: A.4	DIN: D.2
b4	DIN: A.5	DIN: D.3
b5	DIN: A.6	DIN: D.4
b6	DIN: B.1	DIN: D.5
b7	DIN: B.2	DIN: D.6
b8	DIN: B.3	DIN: E.1
b9	DIN: B.4	DIN: E.2
b10	DIN: B.5	DIN: E.3
b11	DIN: B.6	DIN: E.4
b12	DIN: C.1	DIN: E.5
b13	DIN: C.2	DIN: E.6
b14	DIN: C.3	
b15	DIN: C.4	

V1.2.7 Warning Word 1 ID 1174

	Warning Word 1 ID1174
Bit	Warning(s)
B0	
B1	W29 Thermistor F56 Measured Temperature 1, F65 Measured Temperature 2 F71 LCL Over Temperature
B2	
B3	W11 Supply Phase
B4	
B5	
B6	
B7	
B8	W14 Unit Over Temperature
B9	
B10	F32 Fan Fault, F70 LCL Fan Fault
B11	
B12	
B13	
B14	
B15	

V1.2.8 DC Voltage [Vdc] ID44

Unfiltered DC-Link Voltage

V1.2.9 Current [A] ID1113

Total unfiltered current

V1.2.10 Drive Power [kW] ID 1508

Drive input terminal electrical power.

V1.2.11 Fault History ID37

Last active fault. If drive has several fault at the same time see from fault history what was the first fault.

V1.2.12 Final DC Ref [%] ID1131

Final DC Reference, including offset control.

V1.2.13 Cabin State Word ID1884

	Cabin State Word ID1884	
	Fault	Fault Codes
b0	Main Fuse	W81
b1	Aux voltage	W82
b2	STO Fuse	W83
b3	Insulation Fault	W84
b4	Earthswitch Fault	W85
b5	Arc Relay	W86
b6	high Amb Temp.	W88
b7	Leakage	W89
b8	Not used	
b9	Not used	
b10	Not used	
b11	Not used	
b12	Not used	
b13	Not used	
b14	Not used	
b15	Not used	

V1.2.14 Warning ID74

Last active warning. If drive has several warning at the same time see from fault history what was the first warning.

5.2.3 LINE MONITORING OPT-D7

V1.3.1 Line Voltage V ID1650

The measured line voltage rms value when using the OPT-D7 option board in slot C.

V1.3.2 Line Frequency Hz ID1654

The measured line voltage frequency when using the OPT-D7 option board in slot C.

V1.3.3 Synch Error D7 ID1659

An error on voltage angles between the drive and the measurement taken by OPT-D7. -3072...+3071 = -180...180 degrees.
If the value is not near to zero when running in AFE mode, the phase order may be wrong even if the OPT-D7 frequency is correct (Error about 2047 = 120 degree). If measurement is after Dyn11 transformer error is usually about 512 (30,0 Degree).

V1.3.4 Line Voltage THD ID1670

V1.3.5 LineVoltageHFrms ID1671

5.2.4 MASTER/FOLLOWER

Here are gathered relevant signals in Master follower system.

V1.4.1 SB SystemStatus ID 1601

	System Bus Status Word ID1601	
	FALSE	TRUE
b0		Not used
b1		Drive 1 Ready
b2		Drive 1 Running
b3		Drive 1 Fault
b4		Not used
b5		Drive 2 Ready
b6		Drive 2 Running
b7		Drive 2 Fault
b8		Not used
b9		Drive 3 Ready
b10		Drive 3 Running
b11		Drive 3 Fault
b12		Not used
b13		Drive 4 Ready
b14		Drive 4 Running
b15		Drive 4 Fault

V1.4. 2 Master CW ID93

Master Drive Control Word. Master Sending, Follower receiving.

.4.7.1.1 Currents

V1.4.3.1	***Current D1***	***A***	***Varies 1820***
V1.4.3.2	***Current D2***	***A***	***Varies 1821***
V1.4.3.3	***Current D3***	***A***	***Varies 1822***
V1.4.3.4	***Current D4***	***A***	***Varies 1823***

4.7.2 STATUSES

V1.4.4.1	***Status Word D1***	***#***	***1828***
V1.4.4.2	***Status Word D2***	***#***	***1829***
V1.4.4.3	***Status Word D3***	***#***	***1830***
V1.4.4.4	***Status Word D4***	***#***	***1831***

5.2.5 MONITORING VALUES 2

V1.5.1	***Measured temperature 1***	***Cº***	***ID 50***
V1.5.2	***Measured temperature 2***	***Cº***	***ID 51***
V1.5.3	***Measured temperature 3***	***Cº***	***ID 52***
V1.5.4	***Measured temperature 4***	***Cº***	***ID 69***
V1.5.5	***Measured temperature 5***	***Cº***	***ID 70***
V1.5.6	***Measured temperature 6***	***Cº***	***ID 71***
V1.5.7	***PT-100 Temperature***	***Cº***	***ID 42***

Highest temperature of OPTB8/OPTBH board. 4 s filtering.

4.7.3 PIC CONTROLLER

Monitoring values for power controller in AFE mode

V1.6.1 PID Reference 20

Active Current reference

V1.6.2 PID Actual Value 21

Active current

V1.6.3 PID Output 23

PID controller output for DC Voltage reference, gives an offset for DC Voltage Reference.

5. PARAMETER LIST

6.1 BASIC PARAMETERS

Code	Parameter	Min	Max	Unit	Default	ID	Note
P2.1.1	Grid Nominal Voltage	500V: 380V 690V: 525V	500V: 500V 690V: 690V	V	400	110	Set here the nominal voltage of the grid.
P2.1.2	Grid Nominal Frequency	48	63	Hz	50	1532	Set here the nominal frequency of the grid.
P2.1.3	System Rated Current	0,0	Ih	A	Ih	113	Capacity of supply, used if oversized AFE.
P2.1.4	System Rated Power	0	32000	kW	0	116	
P2.1.5	Parallel AFE	0	3		0	1501	**0** = Single AFE **1** = Parallel AFE **1** = Master **1** = Follower

Table 4-2. Basic parameters

6.2 REFERENCE HANDLING

Code	Parameter	Min	Max	Unit	Default	ID	Note
P2.2.1	DC Voltage Ref.	105	Varies	%	110,00	1462	DC Voltage reference as % of Nominal DC Voltage Nominal DC voltage = 1,35 * Supply voltage
P 2.2.2	DC Voltage Drooping	0,00	100,00		0,00	620	AFE drooping DC-voltage. Set to 3,00 % when parallel AFE operation is selected
P2.2.3	Reactive Current Reference	-100,0	100,0	%	0,0	1459	Regenerative reactive current reference 100,0 = nominal current. Positive =Inductive Negative = Capacitive
P2.2.4	DC Reference Offset	-5,00	5,00	%	0,00	1777	

Table 1- 1, Reference Handling

5.8 PIC FUNCTION

Code	Parameter	Min	Max	Unit	Default	ID	Description
P2.2.5.1	PIC Enable	0.1	E.10			1905	
P2.2.5.2	PIC Control Mode	0	2			1914	
P2.2.5.3	PIC Reference	-320	320	%		167	
P2.2.5.4	PIC Kp	1	3200	%		19111	
P2.2.5.5	PIC Ti	0	3200	ms		1906	
P2.2.5.6	PID DC Low	-50	50	%		1903	
P2.2.5.7	PIC DC High	-50	50	%		1906	

5.9 INPUT SIGNALS

6.2.1 DIGITAL INPUTS

Code	Parameter	Min	Max	Unit	Default	ID	Description
P2.3.1.1	Start Signal 1	0.1	E.10	DigIn:	A.1	403	
P2.3.1.2	Enable MCB Close	0.1	E.10	DigIn:	0.2	1619	With CO.B00; Opens MCB also
P2.3.1.3	Open MCB Power Dawn	0.1	E.10	DigIn:	0.2	1600	Power down command
P2.3.1.4	LCL Temp. X51	0.1	E.10	DigIn:	0.2	1179	
P2.3.1.5	LCL Temp. X52	0.1	E.10	DigIn:	0.2	1125	
P2.3.1.6	MCB Status	0.1	E.10	DigIn:	A.4	1453	
P2.3.1.7	Run Enable	0.1	E.10	DigIn:	0.2	407	
P2.3.1.8	Quick Stop	0.1	E.10	DigIn:	0.2	1213	Power down with a warning
P2.3.1.9	Ext. Fault 1	0.1	E.10	DigIn:	0.1	405	
P2.3.1.10	Ext. Fault 2	0.1	E.10	DigIn:	0.1	406	
P2.3.1.11	Fault Reset	0.1	E.10	DigIn:	0.1	414	
P2.3.1.12	LC Cooling	0.1	E.10	DigIn:	0.2	750	
P2.3.1.13	MCB Trip State	0.1	E.10	DigIn	0.1	1706	
P2.3.1.14	Control from I/O terminal	0.1	0.1	DigIn	0.1	409	Force control place to I/O terminal (cc)
P2.3.1.15	Control from keypad	0.1	0.1	DigIn	0.1	410	Force control place to keypad (cc)
P2.3.1.16	Control from fieldbus	0.1	0.1	DigIn	0.1	411	Force control place to fieldbus (cc)

Table 4-3. Digital inputs parameters

6.2.2 ANALOGUE INPUT 1

Code	Parameter	Min	Max	Unit	Default	ID	Note
P2.3.2.1	AI1 signal selection	0.1	E.10	AnIN:	0.1	377	
P2.3.2.2	AI1 filter time	0,000	32,000	s	0,000	324	
P2.3.2.3	AI1 custom minimum setting	-160,00	160,00	%	0,00	321	
P2.3.2.4	AI1 custom maximum setting	-160,00	160,00	%	100,00	322	
P2.3.2.5	AI1 signal inversion	0	1		0	387	
P2.3.2.6	AI1 reference scaling, minimum value	-32000	32000		0	303	
P2.3.2.7	AI1 reference scaling, maximum value	-32000	32000		0	304	
P2.3.2.8	AI1 Controlled ID	0	10000		0	1507	

Table 1- 2, ANALOG INPUT1,

6.2.3 ANALOGUE INPUT 2

Code	Parameter	Min	Max	Unit	Default	ID	Note
P2.3.3.1	AI2 signal selection	0.1	E.10	AnIN:	0.1	388	
P2.3.3.2	AI2 filter time	0,000	32,000	s	0,000	329	
P2.3.3.3	AI2 custom minimum setting	-160,00	160,00	%	0,00	326	
P2.3.3.4	AI2 custom maximum setting	-160,00	160,00	%	100,00	327	
P2.3.3.5	AI2 signal inversion	0	1		0	398	
P2.3.3.6	AI2 reference scaling, minimum value	-32000	32000		0	393	
P2.2.3.7	AI2 reference scaling, maximum value	-32000	32000		0	394	
P2.3.3.8	AI2 Controlled ID	0	10000		0	1511	

Table 1- 3, ANALOG INPUT2

6.2.4 CABIN STATE DI

Code	Parameter	Min	Max	Unit	Default	ID	Description
P2.3.4.1	Main Fuse	0.1	E.10	DigIn:	0.2	1700	
P2.3.4.2	Aux Voltage	0.1	E.10	DigIn:	0.2	1703	
P2.3.4.3	STO Fuse	0.1	E.10	DigIn:	0.2	1702	
P2.3.4.4	Insulation Fault	0.1	E.10	DigIn:	0.2	1704	
P2.3.4.5	Earthswitch Fault	0.1	E.10	DigIn:	0.2	1732	
P2.3.4.6	Arc Relay	0.1	E.10	DigIn:	0.2	1733	
P2.3.4.7	High Amb Temp.	0.1	E.10	DigIn:	0.2	1734	
P2.3.4.8	Leakage	0.1	E.10	DigIn:	0.2	1735	
P2.3.4.9	Klixon In 1	0.1	E.10	DigIn	0.2	780	
P2.3.4.10	Klixon In 2	0.1	E.10	DigIn	0.2	781	
P2.3.4.11	Input Switch	0.1	E.10	DigIn	0.2	1209	

6.2.5 OPTIONS

Code	Parameter	Min	Max	Unit	Default	ID	Note
P2.3.5.1	Start/Stop Logic	0	2		0	300	0/Static 1/ Rising edge 2/ Pulse
P2.3.5.2	Input Inversion	0	65535		0	1091	

Table 1- 4, Digital input options

6.3 OUTPUT SIGNALS

6.3.1 DIGITAL OUTPUTS

Code	Parameter	Min	Max	Unit	Default	ID	Description
P2.4.1.1	MCB Control (Close)	B.2	B.2	DigOUT:	B.2	1218	Static if ID1219 < DigOUT:A.1
P2.4.1.2	MCB Control Open	0.1	E.10	DigOUT:	0.1	1219	Pulse, if used also ID1218 is pulse control.
P2.4.1.3	Ready	0.1	E.10	DigOUT:	0.1	432	
P2.4.1.4	Run	0.1	E.10	DigOUT:	0.1	433	
P2.4.1.5	Fault	0.1	E.10	DigOUT:	0.1	434	
P2.4.1.6	Fault,Inverted	0.1	E.10	DigOUT:	0.1	435	
P2.4.1.7	Warning	0.1	E.10	DigOUT:	0.1	436	
P2.4.1.8	DC Above Limit	0.1	E.10	DigOUT:	0.1	451	
P2.4.1.9	DC Charge	0.1	E.10	DigOUT:	0.1	1668	
P2.4.1.10	Ready To Start	0.1	E.10	DigOUT:	0.1	1686	
P2.4.1.11	FB Dig Input 1	0.1	E.10	DigOUT:	0.1	455	
P2.4.1.12	FB Dig 1 Input Par	0	10000	ID	0	891	
P2.4.1.13	FB Dig Input 2	0.1	E.10	DigOUT:	0.1	456	
P2.4.1.14	FB Dig 2 Input Par	0	10000	ID	0	892	
P2.4.1.15	FB Dig Input 3	0.1	E.10	DigOUT:	0.1	457	
P2.4.1.16	FB Dig 3 Input Par	0	10000	ID	0	893	
P2.4.1.17	FB Dig Input 4	0.1	E.10	DigOUT:	0.1	169	
P2.4.1.18	FB Dig 4 Input Par	0	10000	ID	0	894	
P2.4.1.19	FB Dig Input 5	0.1	E.10	DigOUT:	0.1	170	
P2.4.1.20	FB Dig 5 Input Par	0	10000	ID	0	895	

Table 4-4. Digital outputs parameters

6.3.2 ANALOG OUTPUT 1

Code	Parameter	Min	Max	Unit	Default	ID	Note
P2.4.2.1	Iout 1 signal	0.1	E.10	AnOUT	A.1	464	
P2.4.2.2	Iout Content	0	4			307	0 = 4 mA 1 = DC-Link Voltage 2 = Current 3 = Power 4 = +- Power
P2.4.2.3	Iout Filter Time	0	10	s	1	308	0=No filtering
P2.4.2.4	Iout Invert	0	1		0	309	0=Not inverted 1=Inverted
P2.4.2.5	Iout Minimum	0	1		0	310	0=0 mA 1=4 mA
P2.4.2.6	Iout Scale	10	1000	%	100	311	Percentage multiplier. Defines output when content is it maximum value
P2.4.2.7	Iout Offset	-100	100	%	0	375	Add -1000 to 1000% to the analogue output.

Table 1- 5, Output signals, G2.3.4

6.3.3 OPTIONS

Code	Parameter	Min	Max	Unit	Default	ID	Note
P2.4.3.1	Output Inversion	0	1		0	1806	
P2.4.3.2	MCB Close Mode	0	2		0	1607	0 = DC Voltage 1 = DC or Start command 2 = Start Command.
P2.4.3.3	MCB At Stop Command	0	1		0	1685	0 = Keep CB Closed 1 = Open CB

6.5 LIMIT SETTINGS

5.9.1 CURRENT LIMIT

Code	Parameter	Min	Max	Unit	Default	ID	Note
P2.5.1.1	Current Limit	0	Varies	A	Varies	107	Total current limit
P2.5.1.2	Output Active Current Limit	0	300,0	%	150,0	1290	Generating Active Current limit in AFE mode to grid.
P2.5.1.3	Input Active Current Limit	0	300,0	%	150,0	1289	Motoring active current limit in AFE mode to DC-link.

5.9.2 POWER LIMIT

Code	Parameter	Min	Max	Unit	Default	ID	Note
P 2.5.2.1	Output Power Lim	0	300,0	%	150,0	1288	Generating power limit
P 2.5.2.2	Input Power Lim	0	300,0	%	150,0	1287	Motoring power limit

5.9.3 FREQUENCY LIMIT

Code	Parameter	Min	Max	Unit	Default	ID	Note
P 2.5.3.1	Low Frequency Trip Limit	42	120	%	80	1717	
P 2.5.3.2	High Frequency Trip Limit	42	120	%	120	1716	

5.9.4 AC VOLTAGE LIMIT

Code	Parameter	Min	Max	Unit	Default	ID	Note
P 2.5.4.1	Low AC Voltage Trip Limit	50	150	%	80	1711	
P 2.5.4.2	High AC Voltage Trip Limit	50	150	%	120	1710	

5.9.5 DC VOLTAGE LIMIT

Code	Parameter	Min	Max	Unit	Default	ID	Note
P2.5.5.1	DC Super Vision Limit	0	1300	Vdc	600	1454	
P2.5.5.2	High MCB Close Limit	0	1300	Vdc	0	1251	

5.10 DRIVE CONTROL PARAMETERS

Code	Parameter	Min	Max	Unit	Default	ID	Description
P2.6.1	AFE Options 1	0	65535		544	1463	
P2.6.2	AFE Options 2	0	65535		0	1464	
P2.6.3	Control Options	0	65536		0	1707	Control word for activating special features.
P2.6.4	Start Delay	0,00	320,00	s	0,50	1500	Starting delay when run command is given. When programming different delay to paralleled units, the units will start in sequence.
P2.6.5	Modulator Type	0	4		Single: 2 Parallel 1	1516	**0** = Hardware **1** = Software 1 **2** = Software 2 **3** = Software 3 **4** = Software 4
P2.6.6	Operation Time	0	2^32			1855	

Table 4-6. Drive control parameters G2.4

5.10.1 CONTROL

Code	Parameter	Min	Max	Unit	Default	ID	Description
P2.6.7.1	Capacitor Size	0	100	%	6,3	1460	
P2.6.7.2	Inductor Size	0	100	%	15,5	1461	
P2.6.7.3	Dynamic Support Kp	0	32000		0	1797	
P2.6.7.4	Synch Kp	0	32000		2000	1457	
P2.6.7.5	Synch Ti	0	1000		50	1458	
P2.6.7.6	Active Current Kp	0	4000		400	1455	
P2.6.7.7	Active Current Ti	0,0	100,0		1,5	1456	
P2.6.7.8	Synch. Kp Start	0	10000		4000	1300	
P2.6.7.9	Voltage Ctrl Kp	0	32000		200	1451	
P2.6.7.10	Voltage Ctrl Ti	0	1000	ms	50	1452	
P2.6.7.11	Switching Frequency	3,4	Varies	Hz	3,6	601	
P2.6.7.12	DCLinkMeasCalib	-2,00	2,00	%	0,00	549	
P2.6.7.13	Modulator #2 DPWM Optimization	0	1		1	1682	

Table 4-6. Drive control parameters G2.4

5.11 PROTECTIONS

5.11.1 GENERAL

Code	Parameter	Min	Max	Unit	Default	ID	Description
P2.7.1.1	Response to Thermistor fault	0	3		2	732	**0**=No response **1**=Warning **2**=Fault **3**=Fault, DC OFF
P2.7.1.2	Input Filter Over Temperature Response	0	3		2	1505	**0**=No response **1**=Warning **2**=Fault **3**=Fault, DC OFF
P2.7.1.3	MCB At Fault	0	1		0	1699	
P2.7.1.4	Charge Max Time	0,00	60,00	s	10,00	1522	Charging time limit when drive charging options are used.
P2.7.1.5	Fault/Warn Indication	0	2		1	1940	**0**=Static **1**=Toggle **2**=Marine
P2.7.1.6	Quick Stop Response	0	2		1	1758	
P2.7.1.7	Run Enable Indication	0	2		1	1177	

Table 4-9. General Protections parameters G2.7.1

5.11.2 TEMPERATURE SENSOR PROTECTIONS

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.7.2.1	No. of used inputs on board 1	0	5		0		739	**0**=Not used (ID Write) **1** = Sensor 1 in use **2** = Sensor 1 & 2 in use **3** = Sensor 1 & 2 & 3 in use **4** = Sensor 2 & 3 in use **5** = Sensor 3 in use
P2.7.2.2	Response to temperature fault	0	3		2		740	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.3.2 **3**=Fault,stop by coasting
P2.7.2.3	Board 1 warning limit	–30,0	200,0	Cº	120,0		741	
P2.7.2.4	Board 1 fault limit	–30,0	200,0	Cº	130,0		742	
P2.7.2.5	No. of uses inputs on board 2	0	5		0		743	**0**=Not used (ID Write) **1** = Sensor 1 in use **2** = Sensor 1 & 2 in use **3** = Sensor 1 & 2 & 3 in use **4** = Sensor 2 & 3 in use **5** = Sensor 3 in use
P2.7.2.6	Response to temperature fault	0	3		2		766	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.3.2 **3**=Fault,stop by coasting
P2.7.2.7	Board 2 warning limit	–30,0	200,0	Cº	120,0		745	
P2.7.2.8	Board 2 fault limit	–30,0	200,0	Cº	130,0		746	
P2.7.2.9.1	Channel 1B Warn	-30,0	200,0	Cº	0,0		764	
P2.7.2.9.2	Channel 1B Fault	-30,0	200,0	Cº	0,0		765	
P2.7.2.9.3	Channel 1C Warn	-30,0	200,0	Cº	0,0		768	
P2.7.2.9.4	Channel 1C Fault	-30,0	200,0	Cº	0,0		769	
P2.7.2.9.5	Channel 2B Warn	-30,0	200,0	Cº	0,0		770	
P2.7.2.9.6	Channel 2B Fault	-30,0	200,0	Cº	0,0		771	
P2.7.2.9.7	Channel 2C Warn	-30,0	200,0	Cº	0,0		772	
P2.7.2.9.8	Channel 2C Fault	-30,0	200,0	Cº	0,0		773	

5.11.3 FIELDBUS

Code	Parameter	Min	Max	Unit	Default	ID	Description
2.7.3.1	FB Fault Response	0	2		2	733	**0**=No response **1**=Warning **2**=Fault
2.7.3.2	FB WD Delay	0,00	30,00		0,00	1354	0,00 = Disabled WD

Table 4-9. Fieldbus Protections parameters G2.7.2

5.11.4 OPT-D7 PROTECTIONS

Code	Parameter	Min	Max	Unit	Default	ID	Description
2.7.4.1	THD Response	0	2		0	1672	
2.7.4.2	THD Warn. Limit	0,00	50,00	%	6,00	1673	
2.7.4.3	THD Fault Limit	0,00	50,00	%	10,00	1674	
2.7.4.4	HF rms Response	0	2		0	1675	
2.7.4.5	HF rms Warn Limit	0,0	400,0	V	20,0	1676	
2.7.4.6	HF rms Fault Limit	0	400,0	V	60,0	1677	

Table 4-9. OPT-D7 Protection parameters G2.7.3

5.11.5 EXTERNAL FAULT

Code	Parameter	Min	Max	Unit	Default	ID	Description
P2.7.5.1	External Fault 1 Response	0	2		2	701	**0**=No response **1**=Warning **2**=Fault
P2.7.5.2	External Fault 2 Response	0	2		2	1504	**0**=No response **1**=Warning **2**=Fault

Table 4-9. Options parameters G2.7.2

5.11.6 COOLING PROTECTION

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.7.6.1	Cooling Fault Response	1	2		2		762	**0**= No Action, Warning **1**= Warning, Warning **2**= Warning, Fault **3**= No Action, Fault
P2.7.6.2	Cooling Fault delay	0.00	7.00	s	2.00		751	

Table 5-29. Cooling Protections parameters

5.11.7 CABIN PROTECTION

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.7.7.1	Klixon Response	0	3		2		782	0 = No Action 1 = Warning, Warning 2 = Warning, Fault 3 = Fault, Fault
P2.7.7.1	Ambient Temp Response	0	2		1		784	0 = No Action 1 = Warning 2 = Fault
P2.7.7.1	Input Switch Response	0	2		2		785	0 = No Action 1 = Warning 2 = Fault

Table 5-29. Cabin Protections parameters

5.11.8 OPTIONS

Code	Parameter	Min	Max	Unit	Default	ID	Description
P2.7.7	Fault Simulation	0	65535		0	1569	
P2.7.8	Reset Datalogger	0	1		0	1857	Resets datalogger to defaults.
P2.7.9	Disable Run Lock	0	1		0	1086	

Table 4-9. Options parameters G2.7.2

5.12 FIELDBUS PARAMETERS

Code	Parameter	Min	Max	Unit	Default	ID	Description
P2.8.1	FB Actual Value Selection	0	65535	ID	7	1853	
P2.8.2	Fieldbus data out 1 selection	0	65535	ID	0	852	Choose monitoring data with parameter ID
P2.8.3	Fieldbus data out 2 selection	0	65535	ID	0	853	
P2.8.4	Fieldbus data out 3 selection	0	65535	ID	0	854	
P2.8.5	Fieldbus data out 4 selection	0	65535	ID	0	855	
P2.8.6	Fieldbus data out 5 selection	0	65535	ID	0	856	
P2.8.7	Fieldbus data out 6 selection	0	65535	ID	0	857	
P2.8.8	Fieldbus data out 7 selection	0	65535	ID	0	858	
P2.8.9	Fieldbus data out 8 selection	0	65535	ID	0	859	
P2.8.10	Fieldbus data in 1 selection	0	65535	ID	0	876	Choose controlled data with parameter ID
P2.8.11	Fieldbus data in 2 selection	0	65535	ID	0	877	
P2.8.12	Fieldbus data in 3 selection	0	65535	ID	0	878	
P2.8.13	Fieldbus data in 4 selection	0	65535	ID	0	879	
P2.8.14	Fieldbus data in 5 selection	0	65535	ID	0	880	
P2.8.15	Fieldbus data in 6 selection	0	65535	ID	0	881	
P2.8.16	Fieldbus data in 7 selection	0	65535	ID	0	882	
P2.8.17	Fieldbus data in 8 selection	0	65535	ID	0	883	
P2.8.18	GSW ID	0	65535	ID	68	897	
P2.8.19	State Machine	0	3		1	896	
P2.8.20	FB Control Slot Sel.	0	5		0	1440	

Table 4-8. Fieldbus parameters G2.6

5.13 ID CONTROL FUNCTIONS

5.13.1 VALUE CONTROL

Table 1. Power reference input signal selection, G2.2.8

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.9.1.1	Control Input Signal ID	0	10000	ID	0		1580	
P2.9.1.2	Control Input Off Limit	-32000	32000		0		1581	
P2.9.1.3	Control Input On Limit	-32000	32000		0		1582	
P2.9.1.4	Control Output Off Value	-32000	32000		0		1583	
P2.9.1.5	Control Output On Value	-32000	32000		0		1584	
P2.9.1.6	Control Output Signal ID	0	10000	ID	0		1585	
P2.9.1.7	Control Mode	0	5		0		1586	0 = SR ABS 1 = Scale ABS 2 = Scale INV ABS 3 = SR 4 = Scale 5 = Scale INV
P2.9.1.8	Control Output Filtering rime	0.000	32.000	s	0.000		1721	

5.13.2 DIN ID CONTROL 1

Table 2. DIN ID control parameters, G2.2.8

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.9.2.1	ID Control DIN	0.1	E.10		0.1		1570	Slot Board input No. If 0.1 ID61 can be controlled from FB
P2.9.2.2	Controlled ID	0	10000	ID	0		1571	Select ID that is controlled by digital input
P2.9.2.3	False value	-32000	32000		0		1572	Value when DI is low
P2.9.2.4	True value	-32000	32000		0		1573	Value when DI is high

5.14 KEYPAD CONTROL (CONTROL KEYPAD: MENU M3)

Code	Parameter	Default	Min	Max	Unit	ID	Description
P3.1	Control place	2	0	2		125	0=Fieldbus 1=I/O terminal 2=Keypad (Default)

Table 4-11. Keypad control parameters M3

5.15 SYSTEM MENU (CONTROL KEYPAD: MENU M6)

For parameters and functions related to the general use of the frequency converter, such as application and language selection, customised parameter sets or information about the hardware and software, see Chapter 7.3.6 in the Vacon NX User's Manual.

5.16 EXPANDER BOARDS (CONTROL KEYPAD: MENU M7)

The **M7** menu shows the expander and option boards attached to the control board and board-related information. For more information, see Chapter 7.3.7 in the Vacon NX User's Manual and Vacon I/O option board manual.

6. DESCRIPTION OF PARAMETERS

6.1 BASIC PARAMETERS

2.1.1 Grid Nominal Voltage [# V] ID110

This parameter sets the incoming line voltage for the regenerative drive. The maximum value is 690 V, Set this parameter to the nominal line voltage at the installation site.

2.1.2 Grid Nominal Frequency [#,## Hz] ID1532

Grid Nominal frequency. Used for frequency protection functions and initial guess for synchronization frequency.

2.1.3 System Rated Current [A] ID113

Rated current capacity of the supply or the transformer. May need to be set if AFE is oversized compared to LCL or feeding transformer capacity. For testing purposes, the feeding transformer should not be less than 20% of the unit nominal current or following breakers or fuses. Recommended not to increase System Rated Current above I_H Current.

2.1.4 System Rated Power [kW] ID116

Set here the rated active power of the system.

2.1.5 Parallel AFE ID1501

0 = Single AFE

1 = Parallel AFE

When selecting parallel, AFE DC Drooping is set to 3,00 %, Software Modulation 1 is activated (Default Software Modulator 2) and modulation is automatically synchronized between AFE units in common DC bus.

2 = Master

When selecting Master, AFE DC Drooping is set to 3,00 %, Software Modulation 1 is activated (Default Software Modulator 2) and modulation is automatically synchronized between AFE units in common DC bus. Start Command is send trough system bus to follower drives

3 = Follower

When selecting follower, AFE DC Drooping is set to 3,00 %, Software Modulation 1 is activated (Default Software Modulator 2) and modulation is automatically synchronized between AFE units in common DC bus. Follower drive revives start command from master drive through system bus.

6.2 REFERENCE HANDLING

P2.2.1 DC Voltage Reference [#,## %] ID1462

This parameter sets the DC Voltage reference in % of Nominal DC voltage (Nominal DC voltage = 1,35 * Grid Nominal Voltage). The DC Voltage will be maintained at this level when regenerative unit is running. Ramp rate for reference is 5 % / 100 ms.

NOTE! DC-link voltage should not exceed the following values:

- 797 Vdc for 500V unit
- 1099 Vdc for 690V unit

DC Voltage is limited to these values regardless of reference.

In fieldbus control DC Voltage Reference can be given in FBSpeedReference signal. If FBSpeedReference is below 50,00 % keypad reference is used instead but minimum is always limited to 105,00 %.

P2.2.2 DC Droop ID620

When AFEs are used in parallel, drooping can be used for current balancing. The DCV voltage reference drooping is set as % of active current reference.

E.g. if drooping is 3.00% and active current is 50% then DC voltage reference is reduced 1,5%.

P2.2.3 Reactive Current Reference ID1459

This parameter sets the reference for the reactive current in % of the rated current. This can be used for power factor correction of AFE system or reactive power compensation.

Positive value makes inductive power to the grid
Negative value makes capacitive power to the grid.

P2.2.4 DC Reference Offset

Offset for DC Reference, used to balance parallel unit active current while using same DC Reference P2.2.1. in all units.

6.2.1 PIC FUNCTION

P2.2.5.1 PIC Enable ID1905

Select digital input to activate PID Power control function. Use ID1914 to select control mode.

P2.2.5.2 PIC Control Mode ID1914

This parameter is used to select control mode.

0 = Disabled

1 = Drive will control AC side active current

2 = Drive will control DC Current

P2.2.5.3 PIC Reference ID167

PIC Reference parameter

P2.2.5.4 PIC Kp ID1911

PIC Control Gain

P2.2.5.5 PIC Ti ID1906

PIC Controller integration time in ms.

P2.2.5.6 PID DC Low ID1903

Limit for PIC controlled how much DC Reference can be lowered to maintain reference.

P2.2.5.7 PIC DC High ID1906

Limit for PIC controlled how much DC Reference can be increased to maintain reference.

6.3 INPUT SIGNALS

6.3.1 DIGITAL INPUTS

P2.3.1.1 Start Signal 1 ID403

Start signal, See Start/Stop Logic ID 300.

P2.3.1.2 Enable MCB Close ID1619

Enables MCB closing, false keeps MCB open even if required DC Voltage level has been reached. With Control Options B00 MCB is also opened without need to discharge DC link.

P2.3.1.3 Open MCB PowerDown ID1600

Signal FALSE status will stop the AFE unit and discharge DC.
System is powered down.

On keypad control pressing Stop button more than a 2 second will open the MCB.

P2.3.1.4 LCL Temp. X51 ID1179

This parameter defines if the drive monitors the status of the LCL Fan of the unit. If the monitoring function is used, the unit will give a warning if the LCL fan stops working and LCL temperature reaches warning level.

Check from hardware if LCL is using X51 for fan monitoring or for LCL Temperature monitoring. If hardware uses X51 for fan monitoring use this parameter if it is used for LCL temperature monitoring use P2.3.1.10 LCL Temperature Monitoring X51.

This signal is normally used in cabinet installations. If status of the LCL fan is not monitored in the system the option “0 = Not used” must be chosen.

P2.3.1.5 LCL Temp. X52 ID1125

This parameter defines if the drive monitors the status of the LCL over temperature switch signal. This wire is marked as “X52” when not using integrated DC/DC power supply.

This signal is normally used in cabinet installations. If LCL Over temperature monitoring signal is not used in the system the option “0 = Not used” must be chosen.

P2.3.1.6 MCB Status ID1453

This parameter defines what input is used to monitor status of the MCB of the unit. If feedback does not correspond the control signal within 4 second time delay drive will indicate MCC Fault and will not be able to start until proper feedback is give. If feedback is lost during run state fault is immediate and MCB Open command is given.

NOTE! AFE needs feedback signal for correct operation. If feedback is not used there will be 3 second delay after closing command before drive can be started.

NOTE! Missing feedback signal prevent drive going to ready state. MCB Feedback can be monitored from Status Word B10.

NOTE! If feedback is not used there will be three second forced delay on internally generated MCB feedback signal. MCB Feedback can be monitored from Status Word B10.

P2.3.1.7 Run Enable ID407

This parameter defines which digital input is used for external Run Enable signal. If Run Enable is used the drive does not go to Ready state until the Run Enable goes high.

P2.3.1.8 Quick Stop (Power Down) ID1213

Drive is stopped and MCB is opened immediately and DC needs to go zero to make restart. Power Down command with a warning indication (Recorded to fault history).

P2.3.1.9 Ext. Fault 1 ID405

P2.3.1.10 Ext. Fault 2 ID406

This parameter defines if the drive monitors the status of the External fault input. The response to the fault can be selected with the parameter P2.7.2.

P2.3.1.11 Fault Reset ID414

This parameter defines which digital input is used to reset faults.

P2.3.1.12 LC Cooling ID750

OK input from the cooling unit. Warning indication if unit is not in run state or there is not active run request. Response is fault within 3 second if unit is in run state or there is an active run request.

P2.3.1.13 MCB Trip State ID1706

Input signal for Main Circuit Breaker trip state. Gives F64 with and subcode.

.6.3.1.1 Forced control place

Digital inputs can be used to bypass parameter P3.1 Control Place, for example, in an emergency situation when PLC is not able to send command to the drive.

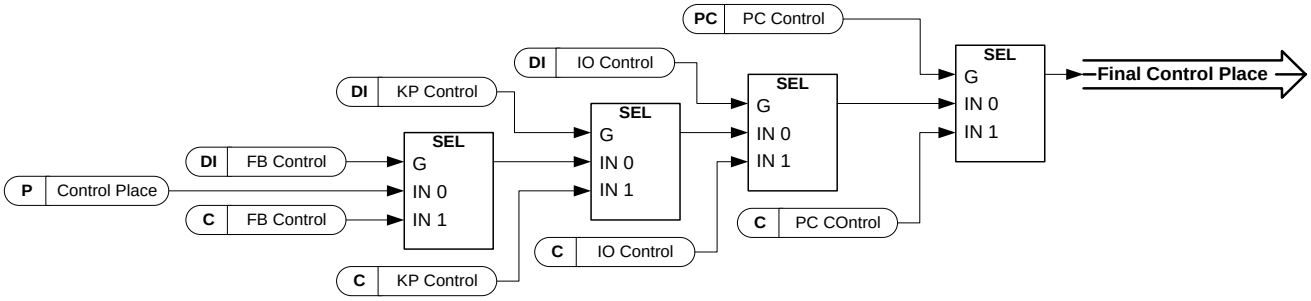


Figure 6-1. Control place selection priority order

P2.3.1.14 Control from I/O terminal ID409 "I/O Term Control"

Contact closed: Force control place to I/O terminal

P2.3.1.15 Control from keypad ID410 "Keypad Control"

Contact closed: Force control place to keypad

P2.3.1.16 Control from Fieldbus ID411 "Fieldbus Control"

Contact closed: Force control place to fieldbus

NOTE: When the control place is forced to change the values of Start/Stop, Direction and Reference valid in the respective control place are used. The value of parameter ID125 (Keypad Control Place) does not change. When the input opens the control place is selected according to keypad control parameter P3.1 Control Place

6.3.2 ANALOGUE INPUTS

2.3.2.1 AI1 signal selection ID377 "AI1 Signal Sel"

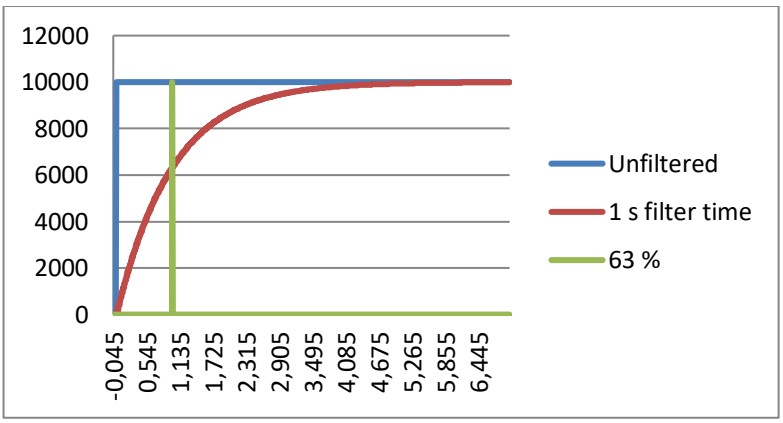
2.3.2.1 AI2 signal selection ID388 "AI2 Signal Sel"

Connect the AI1/AI2 signal to the analogue input of your choice with this parameter. When analogue input selection parameter is set to 0.1 you can control analogue input monitoring variable from Fieldbus by assign process data input ID number to monitoring signal thus allowing making of scaling function in drive side to PLC input signals.

2.3.2.2 Analogue input 1 signal filtering time ID324 "AI1 Filter Time"

2.3.2.2 Analogue input 2 signal filtering time ID329 "AI2 Filter Time"

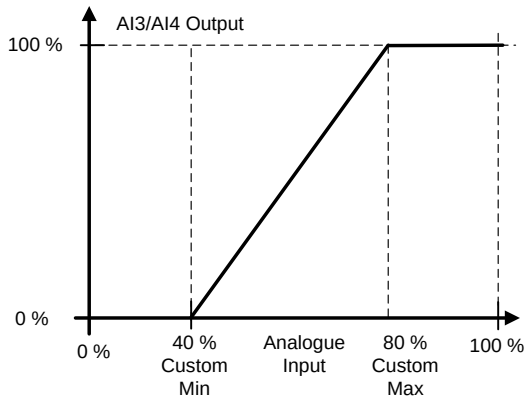
First order filtering is used for analogue inputs signals 3 and 4.



2.3.2.3 AI1 custom setting minimum ID321 "AI1 Custom Min"
2.3.2.4 AI1 custom setting maximum ID322 "AI1 Custom Max"

2.3.3.3 AI2 custom setting minimum ID326 "AI2 Custom Min"
2.3.3.4 AI2 custom setting maximum ID327 "AI2 Custom Max"

Set the custom minimum and maximum input levels for the AI1/AI2 signal within -160…160%.

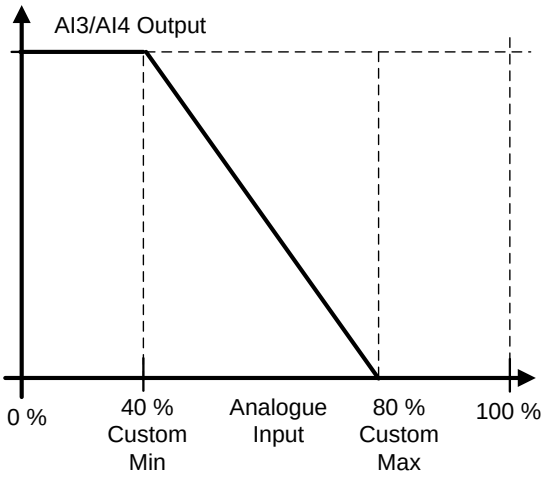


2.3.2.5 AI1 signal inversion ID387 "AI1 Signal Inv"

2.3.3.5 AI2 signal inversion ID398 "AI2 Signal Inv"

Signal inversion function is useful in situation when e.g. PLC is sending power limit to the drive by using analogue inputs, if PLC is unable to communicate to the drive power limit would be normally zero, by using inverted signal logic zero value from PLC would mean maximum power limit thus allowing drive running e.g. from keypad without changing power limit function parameters.

0 = No inversion
1 = Signal inverted



.6.3.2.1 Analogue input to any parameter

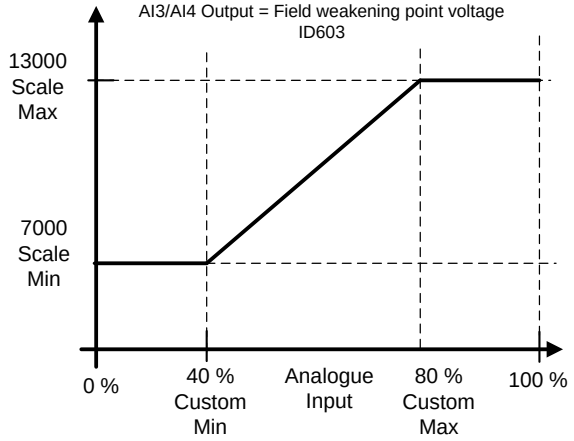
This function allows control of any parameter by using analogue input. with parameters it is selected what will be range of control area and ID number for paramter that is controller

2.3.2.6	***Analogue input 1, minimum value***	***ID303 "AI1 Scale Min"***
2.3.2.7	***Analogue input 1, maximum value***	***ID304 "AI1 Scale Max"***
2.3.3.6	***Analogue input 2, minimum value***	***ID393 "AI2 Scale Min"***
2.3.3.7	***Analogue input 2, maximum value***	***ID394 "AI2 Scale Max"***

These parameters are defining range for controlled parameter. All the values are considered to be integers thus when controlling FWP as in example you need to set also numbers for decimals. e.g. FWP 100,00 needs to be set as 10000.

2.3.2.8	***AI1 Controlled ID***	***ID1507***	***"AI1 Control. ID"***
2.3.3.8	***AI2 Controlled ID***	***ID1511***	***"AI2 Control. ID"***

These parameters define what controller parameter is.
Example:
You want to control motor field weakening point voltage by analogue input from 70,00 % to 130,00 %.
Set Scale min to 7000 = 70,00 %
Set Scale max to 13000 = 130,00 %
Set Controlled ID to 603 Voltage at filed weakening point



Now analogue input 3 signal 0 V to 10 V (0 mA to 20 mA) will control field weakening point voltage between 70,00 % - 130,00 %. When setting value, decimals are handled as integer.

6.3.3 CABIN STATE DI

P2.3.4.1 Main Fuse ID1700

P2.3.4.2 Aux Voltage ID1703

P2.3.4.3 STO Fuse ID1702

P2.3.4.4 Insulation Fault ID1704

P2.3.4.5 Earth switch Fault ID1732

P2.3.4.6 Arc Relay ID1733

P2.3.4.7 High Amb. Temp ID1734

Ambient temperature monitoring input Low signal will generate waring W88 Ambien Temp.

P2.3.4.8 Leakage ID1735

P2.3.4.9 Klixon In 1 ID780

Klixon type temperature monitoring input 1. Low signal will generate warning W66 Klixon.

P2.3.4.10 Klixon In 2 ID781

Klixon type temperature monitoring input 2. Low signal will generate fault F66 Klixon.

P2.3.4.11 Input Switch ID1209

Selects the digital input for the status of input switch. The input switch is normally switch fuse unit or main contactor with which the power is fed to the drive. If the input switch feedback is missing, the drive trips on “F55 Input Switch” fault.

6.3.4 OPTIONS

P2.3.5.1 Stat/Stop Logic ID300

Start Signal 1 ID 403 command
0 = Static
1 = Rising Edge
2 = Pulse

P2.3.5.2 Input Inversion ID1091

B00 = +1 = Inv. Open MCB (Force)
B01 = +2 = Inv. External Fault 1
B02 = +4 = Inv. External Fault 2
B03 = +8 = Inv. Enable MCB Close
B04 = +16 = Inv. MCB Trip input.
B05 = +32 = Inv. High Amb Temp.
B06 = +64 =
B07 = +128 = Inv. Input Switch
B08 = +256 = Inv. Klixon Input 1
B09 = +512 = Inv. Klixon Input 2

6.4 OUTPUT SIGNALS

6.4.1 DIGITAL OUTPUTS

P2.4.1.1 MCB Close Control ID1218 "MCB CloseControl"

AFE MCB control, fixed to the relay output B.2.
When P2.4.1.2 is not activated, this output will stay high as long as MCB must be closed. When the signal goes low, MCB must be open.

P2.4.1.2 MCB 1 Open Control ID1219 "MCB OpenControl"

When this output is selected above 0.9, the drive will use pulse control for the MCB breaker. P2.5.1.1 is used to close the breaker with a 2 s pulse.

The opening command is given by with a 2 s pulse.

P2.4.1.3 Ready ID432

The AC drive is ready to operate.

P2.4.1.4 Run ID433

The AC drive operates (the drive is modulating).

P2.4.1.5 Fault ID434

Drive is in fault state

P2.4.1.6 Fault, Inverted ID435

No active faults.

P2.4.1.7 Warning ID436

Warning is active.

P2.4.1.8 DC Above Limit ID451

DC Voltage is above P2.5.5.1 DC Supervision limit.

P2.4.1.9 DC Charge ID1668

This output function is used to charge DC. When run enable is HIGH and there are no active faults, the rising edge on the start command will start the DC charging and if charging is successful, the drive will go to Run State. In fieldbus control, charging is started by FB Control Word B0. If MCB feedback is not received within P:Max Charge Time, fault F80 is generated.

P2.4.1.10 Ready To Start

Drive is ready for charge and start command. No active fault or warnings.

P2.4.1.11 FB Dig Input 1 455

P2.4.1.13 FB Dig Input 2 456

P2.4.1.15 FB Dig Input 3 457

P2.4.1.17 FB Dig Input 4 169

P2.4.1.19 FB Dig Input 5 170

The data from the fieldbus main control word can be led to the digital outputs of the drive. See the fieldbus board manual for the location of these bits.

P2.4.1.12 FB Dig 1 Input Par 891

P2.4.1.14 FB Dig 2 Input Par 892

P2.4.1.16 FB Dig 3 Input Par 893

P2.4.1.18 FB Dig 4 Input Par 894

P2.4.1.20 FB Dig 5 Input Par 895

With these parameters you can define the parameter to be controlled by using FB digital input.
Example:
All option board inputs are already in use, but you want to give a DI: External Fault 1 (ID405) and drive has a fieldbus board.

Set parameter ID892 (Fieldbus Digital Input 2) to 405. Now you are able to control External Fault 1 command from the fieldbus by Profibus control word (bit 11).

It is possible to control any parameter in the same way if values 0 = FALSE and 1 = TRUE are significant for that parameter. For example, P2.1.5 Parallel AFE (ID1501) can be switched on and off using this function (Parallel AFE: 0 = No, 1 = Yes).

6.4.2 ANALOGUE OUTPUTS

P2.4.2.1 Iout 1 signal ID464

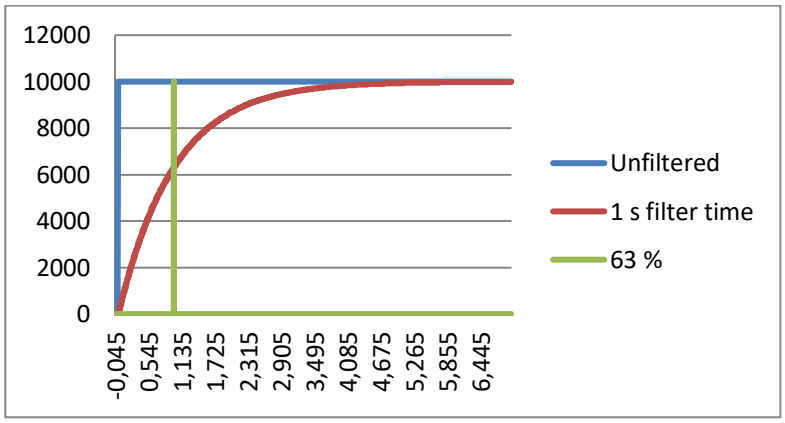
Connect the AO signal to the analogue output of your choice with this parameter.

P2.4.2.2 Iout Content ID307

0 = Not used

P2.4.2.3 Iout Filter Time ID308

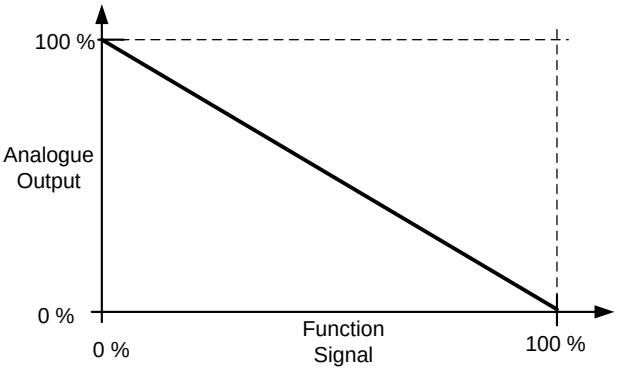
Defines the filtering time of the analogue output signal. Setting this parameter value 0 will deactivate the filtering. First order filtering is used for the analogue output signals.



P2.4.2.4 Iout Invert ID309

Inverts the analogue output signal:

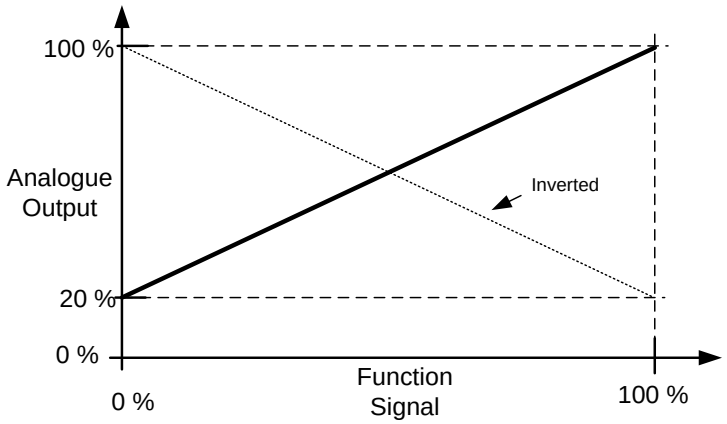
- Maximum output signal = Minimum set value.
- Minimum output signal = Maximum set value.



P2.4.2.5 Iout Minimum ID310

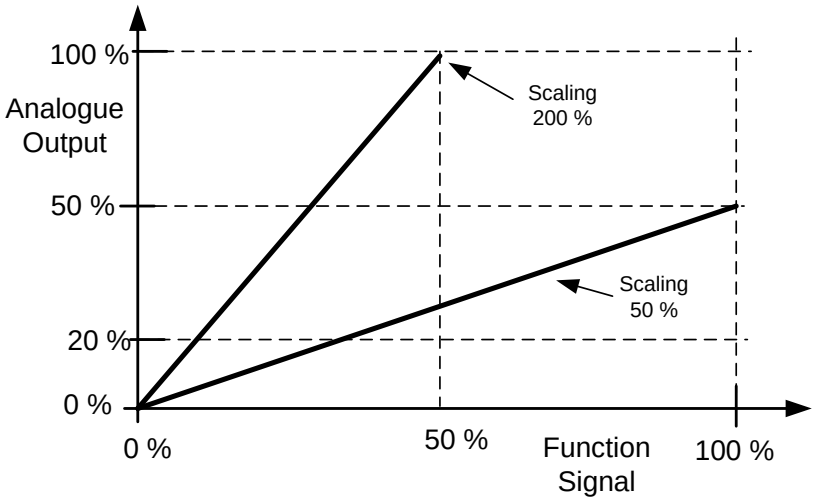
0 = Set minimum value to 0 mA (0%)

1 = Set minimum value to 4 mA (20%)



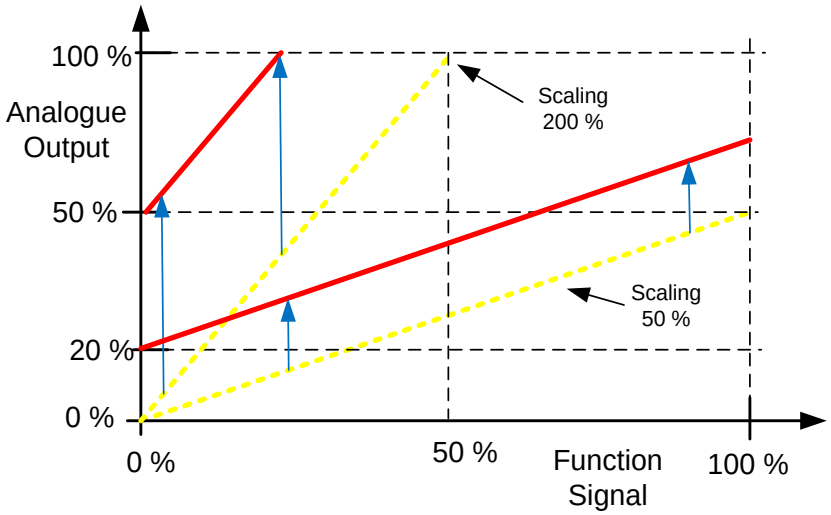
P2.4.2.6 Iout Scale ID311

A scaling factor for an analogue output.



P2.4.2.7 Iout Offset ID375

Add –100.0 to 100.0% to the analogue output.



6.4.3 OPTIONS OUTPUTS

P2.4.3.1 Output Inversion ID1806

With this parameter it is possible to select which output signals are inverted.

B01 = +2 = Invert Common Warning

P2.4.3.2 MCB Close Mode

This parameter defines how the closing of circuit breaker is handled.

0 = DC Voltage

Normal AFE operation type circuit breaker control. The circuit breaker is closed when DC voltage is at a required level.

1 = DC Voltage or Start Command

The circuit breaker is closed when DC voltage is at the required level, or from a start command if DC is at a required level. This can be used when the breaker is opened, for example, by a stop command but DC remains high. It is useful when used in a battery system.

2 = Start Command

The circuit breaker is closed from a start command if DC is at a required level.

P2.4.3.3 MCB At Stop Command ID 1685

The parameter defines the action for MCB when a stop command has been given.

0 = Keep closed

1 = Open CB when drive has stopped

6.5 LIMIT SETTINGS

6.5.1 CURRENT LIMITS

P2.5.1.1 Current Limit [A] ID107

Sets the current limit for the regenerative supply unit. Set this to correspond to the maximum required load or peak overload for the unit, bearing in mind that the load might consist of several motor drive units.

Maximum value 2 * IH depends on the unit size.

P2.5.1.2 Output Active Current Limit [%] ID1290 "OutputActCurLim"

This parameter sets the active current limit for the generator side operation of the regenerative unit. 100.0% is equal to nominal current. Generator Side operations is when power flows from DC side to AC side. Setting too low value may lead to over voltage fault even on situation when power is not mend to regenerate to grid side.

P2.5.1.3 Input Active Current Limit [%] ID1289 "InputActCurrLim"

This parameter sets the active current limit for the motor side operation of the regenerative unit. 100.0% is equal to nominal current. Motoring Side operations is when power flows from AC side to DC side.

6.5.2 POWER LIMITS

P2.5.2.1 Output Power Limit ID1288

This parameter sets the power limit for the generator side operation of the regenerative unit. 100.0% is equal to nominal current at nominal voltage. Generator Side operations is when power flows from DC side to AC side. Setting too low value may lead to over voltage fault even on situation when power is not mend to regenerate to grid side.

P2.5.2.2 Input Power Limit ID1287

This parameter sets the power limit for the motor side operation of the regenerative unit. 100.0% is equal to nominal current at nominal voltage. Motoring Side operations is when power flows from AC side to DC side.

6.5.3 FREQUENCY LIMITS

P2.5.3.1 Line Low Frequency Trip Limit

If the drive output frequency goes below this level, the drive will trip to a line synch fault (F10). Use this limit as a final protection function for the grid or generator.
.

P2.5.3.2 Line High Frequency Trip Limit

If the drive output frequency goes above this level, the drive will trip to a line synch fault (F10). Use this limit as a final protection function for the grid or generator.

6.5.4 AC VOLTAGE LIMITS

P2.5.4.1 Low AC Voltage Trip Limit ID1711

Trip limit for low supply voltage (F92). Note that this is AFE unit terminal voltage; voltage losses in LCL may affect actual drive terminal voltage compared to grid voltage.

P2.5.4.2 High AC Voltage Trip Limit ID1710

Trip limit for high supply voltage (F92). Note that this is AFE unit terminal voltage; voltage losses in LCL may affect actual drive terminal voltage compared to grid voltage.

6.5.5 DC VOLTAGE LIMIT PARAMETERS

P2.5.5.1 DC Voltage supervision limit ID1454

This parameter sets a supervision limit for the DC link voltage. If the voltage increases above this, this signal goes HIGH. This signal can be connected to digital output and it is copied to Main Status Word, Bit 10. This value does not limit the DC-link voltage but it can be used for monitoring purposes.

P2.5.5.2 High MCB Close Limit ID1251

This parameter can be used to increase normal MCB closing level. Example case of use is when there is high capacitance in DC-Link and closing the MCB at normal level will cause current spike.

6.6 DRIVE CONTROL

P2.6.1 AFE Options 1 ID1463

This packed bit word is made for enabling/disabling different control options for regeneration control:

B0 = Disable DCV reduction with reactive reference generation with high line voltage.

B1 = Disable LCL reactive power compensation.

B5 = Disable all harmonic elimination compensation
This is active by default. When activated, this function will reduce little 5^{th} and 7^{th} harmonics. This will not reduce harmonics of the grid, only own harmonics.

B8 = Enable longer synchronization pulse
This option will make longer synchronization pulse to help synchronization on weak grid.

B9 = Enable soft synchronization (>= FI9)
This function enables hardware frequency detection on FI9 and bigger units. When active and there is connection to grid, Supply Frequency is updated by detected frequency. Recommended to disable when Battery or Photovoltaics system.

B12 = Enable floating DC reference. DC-link voltage will follow line voltage.
DC Voltage is increased when supply voltage is higher than set Grid Nominal Voltage.
While run state drive can detect the Supply Voltage, if supply voltage changes also internal DC Reference is changed so that DC Voltage is:

$$DC\ Voltage = MAX(Supply\ Voltage, GridNomVoltage) * 1{,}35 * DC\ Reference$$

B13 = Enable use of D7 board for start synchronization.
When OPT-D7 board is installed this bit will activate synchronization by using voltage angle and frequency information from D7 board. Note that phase order needs to be same in both OPT-D7 and input phases. It is also recommended to keep frequency on positive side. Note that Frequency of D7 board can be same as a Supply Frequency but phase order can be still wrong,

P2.6.2 AFE Options 2

This packed bit word is made for enabling/disabling different control options for the regeneration control.

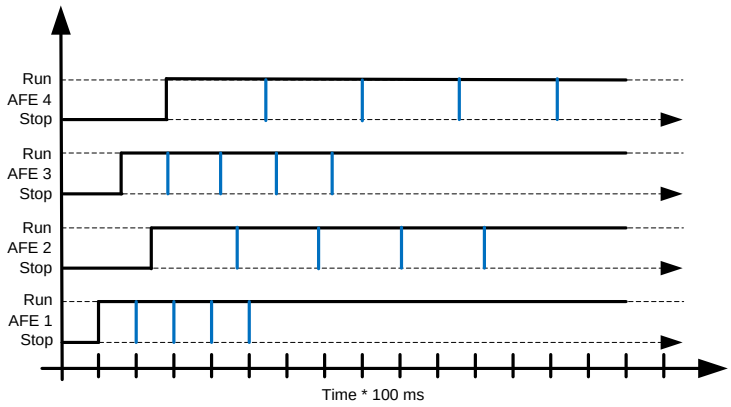
B00 = Reserved

P2.6.3 Control Options ID1798

B00 = +1 = Enable MCB Close (DI and FB), will also open MCB, without need of discharge DC link.
B10 = +1024 = Disable internal F80 DC Charge fault operation.

P2.6.4 Start Delay ID1500

This parameter defines a starting delay when run command is given. When programming different delay to paralleled units, the units will start in sequence. This is needed in parallel units so that synchronization does not happen simultaneously with all drives. Simultaneous starting may lead to failed synchronization. Recommended to set value so that AFE units following start attempts do not happen at the same time with the other units.



P2.6.5 Modulator type ID1516

This Parameter is for changing the modulator type. With ASIC (HW) modulator the current distortion is lower, but losses are higher compared to software modulator. It is recommended to use Software modulator.

0 = Hardware modulator: ASIC modulator, which is classical third harmonic injection. Spectrum is slightly better compared to Software 1 modulator.

1 = Software modulator 1: Symmetric vector modulator with symmetrical zero vectors. Current distortion is less than with software modulator 2 if boosting is used.

2 = Software modulator 2: Symmetric BusClamb, in which one switch always conducts 60 degrees either to negative or positive DC-rail. Switching losses are reduced without different heating of upper and lower switches. Spectrum is narrow. Not recommended for parallel units.

3 = Software modulator 3: Unsymmetric BusClamb, in which one switch always conducts 120 degrees to negative DC-rail to reduce switching losses. Drawback is that upper and lower switches are unevenly loaded and spectrum is wide. Not recommended for parallel units.

4 = Software modulator 4: Pure sine wave, sinusoidal modulator without harmonic injection. Dedicated to be used in back to back test benches etc. to avoid circulating third harmonic current. Drawback is that required DC voltage is 15% higher compared to other modulator types.

P2.6.6 Operation Time ID1855

Stored Operation Time. When application is reloaded operation hours will go zero if this parameter is not updated.
Monitoring signal is in hours with two decimal.
Parameter is in format of:

xx (Years) XX (Monts) XX (Days) XX (Hours) XX Minutes

1211292359 -> 12 years, 11 months, 29 days, 23 hours and 59 minutes.

6.6.1 CONTROL

P2.6.7.1 Capacitor Size [%] (ID1460)

This parameter defines the reactive current going to the LCL filter capacitor. It compensates the LCL effect to the reactive current by adjusting the reactive current reference internally. The inductor size is also added to compensation. If set correctly, the power factor on the grid side will be 1.

P2.6.7.1 Inductor Size [%] (ID1461)

This parameter defines voltage losses in percentage of the nominal voltage at 100% active current. This value is internally added to the reactive current reference thus giving power factor 1 on the grid side, if set correctly together with Capacitor Size. The transformer and feeding cables can be compensated by increasing this value.

P2.6.7.3 Dynamic Support Kp #,# [%/%] ID1797

This function supports weak grid by generating or consuming reactive current in grid under- and over-voltage situations. Reactive current is generated/consumed with gradient by set parameter value by every 1 % decrease/ increase in grid voltage to stabilize voltage in the point of coupling.

P2.6.7.4 Synch Kp ID1457

This parameter sets the gain of the synchronisation controller used to synchronise the switching to the supply.

P2.6.7.5 Synch Ti ID1458

This parameter sets the time constant of the controller used to synchronise the switching to the supply (15 equals 7ms).

P2.6.7.6 Active Current Kp ID1455

This parameter sets the gain of the controller for the active current of the regenerative unit.

P2.6.7.7 Active Currnt Ti ID1456

This parameter sets the time constant of the controller for the active current of the regenerative unit (15 equals 1.5ms).

P2.6.7.8 Synch. Kp Start ID1300

P2.6.7.9 Voltage Control Kp ID1451

This parameter sets the gain for the DC link PI voltage controller.

P2.6.7.10 Voltage Control Ti ID1452

This parameter sets the time constant in ms of the DC link PI controller.

P2.6.7.11 Switching frequency ID601

The switching frequency of the IGBT bridge in kHz. Changing the default value may impact on the LCL filter operation.

P2.6.7.12 DCLinkMeasCalib ID549

To increase the DC-voltage accuracy you may use ID549 to adjust the DC-link voltage measurement shown by the converter. This parameter will add a small gain offset to the measured DC-link voltage value. This feature helps to balance the load sharing for parallel converters.

P2.6.7.13 Modulator #2 DPWM Optimization ID1682

This function enables use of Grid Converter Modulator used with parallel Grid Converters. Active only when Software Modulator #2 is used. Operation is same as software modulator 2 when mindex > 75 % and same as software modulator 1 when mindez < 25 %.

6.7 PROTECTIONS

6.7.1 GENERAL

P2.7.1.1 Response to thermistor fault ID732

0 = No response
1 = Warning
2 = Fault (the drive will stop modulation leaving MCB closed)
3 = Fault, DC off (MCB open)

Setting the parameter to 0 will deactivate the protection.

P2.7.1.2 Response to Input Filter over temperature ID1505

This parameter defines a response to LCL over temperature fault. LCL fault is monitored through digital input defined in parameter P2.2.1.3.

0 = No response
1 = Warning
2 = Fault (the drive will stop modulation leaving MCB closed)
3 = Fault, DC off (MCB open)

P2.7.1.4 MCB on Fault ID1510

This parameter defines response to ANY fault what occurs in the AFE.

0 = MCB is kept closed in case of fault
- Faults that have been defined to open MCB are still active.

1 = Any fault in the drive will open the MCB.
- Auto reset of MCC fault will be disabled with this selection.

P2.7.1.5 Charge Max Time ID1522

When drive charging options is used this parameter defines maximum time limit for charging. Use suitably sized DC Charging resistor by checking Pulse loadability for time duration set in for Max Charge Time parameter

P2.7.1.6 FaultWarnIndicat ID1940

With this parameter its possible to select how warning and fault indication as handled to digital outputs and to fieldbus
0 = Static

Static signal, as long as warning or fault is active

1 = Toggle

New fault or warning toggles signal for one second.

2 = Marine

Signal toggles in new fault or warning and status needs to be reset to get signal down.

P2.7.1.6 Quick Stop Response ID1758

This function will stop the drive at any case. This parameter is used to select which action is shown on keypad.
0 = No response
1 = Warning
2 = Fault

P2.7.1.7 Run Enable Indication ID1177

Select the response for Run Enable low signal, drive will lose ready status regardless what response has been selected here.

0 = No Action

1 = Warning

2 = Fault

6.7.2 TEMPERATURE SENSOR PROTECTIONS

The temperature protection function is used to measure temperatures and issue warnings and/or faults when the set limits are exceeded. The AFEII application supports two OPT-BH and OPT-B8 board simultaneously.

P2.7.2.1 Number of used inputs in board 1 ID739 "Board1 Channels"

Select used temperature sensor combination with this parameter. See also the Vacon I/O boards manual.

0 = Not used (ID Write, value of maximum temperature can be written from fieldbus)
1 = Sensor 1 in use
2 = Sensor 1 & 2 in use
3 = Sensor 1 & 2 & 3 in use
4 = Sensor 2 & 3 in use
5 = Sensor 3 in use

Note: If the selected value is greater than the actual number of used sensor inputs, the display will read 200ºC. If the input is short-circuited the displayed value is –30ºC.

P2.7.2.2 Board 1 Temperature response ID740 "Board1 Response"

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to Stop Function
3 = Fault, stop mode after fault always by coasting

P2.7.2.3 Board 1 warning limit ID741 "Board1Warn.Limit"

Set here the limit at which the PT100 warning will be activated.
When individual warning and fault limits are activated this is first board first channel (1A).

P2.7.2.4 Board 1 fault limit ID742 "Board1 Fault Lim."

Set here the limit at which the PT100 fault (F56) will be activated.
When individual warning and fault limits are activated this is first board first channel (1A).

P2.7.2.5 Number of used inputs in board 2 ID743 "Board2 Channels"

If you have two temperature sensor boards installed in your frequency converter you can choose here the combination inputs in use in the second board. See also the Vacon I/O boards manual.

0 = Not used (ID Write, value of maximum temperature can be written from fieldbus)
1 = Sensor 1 in use
2 = Sensor 1 & 2 in use
3 = Sensor 1 & 2 & 3 in use
4 = Sensor 2 & 3 in use
5 = Sensor 3 in use

P2.7.2.6 Board 2 Temperature response ID766 "Board2 Response"

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to Stop Function
3 = Fault, stop mode after fault always by coasting

P2.7.2.7 Board 2 warning limit ID745 "Board2 Warn. Lim"

Set here the limit at which the second temperature sensor board warning will be activated. When individual warning and fault limits are activated this is second board first channel (2A).

P2.7.2.8 Board2 fault limit ID746 "Board2 FaultLim"

Set here the limit at which the second temperature sensor board fault (F61) will be activated. When individual warning and fault limits are activated this is second board first channel (2A).

.6.7.2.1 Individual channel monitoring

Individual channel monitoring is activated by setting one of the warning limits (per board) different than zero. Common limits in above parameters will be channel A warning and fault limits. Channel B and C limits are set with below parameters.

P2.7.2.9.1 Channel 1B Warn ID764

P2.7.2.9.2 Channel 1B Fault ID765

First board second (1B) channel warning and fault limits.

P2.7.2.9.3 Channel 1C Warn ID768

P2.7.2.9.4 Channel 1C Fault ID769

First board third (1C) channel warning and fault limits.

P2.7.2.9.5 Channel 2B Warn ID770

P2.7.2.9.6 Channel 2B Fault ID771

Second board second (2B) channel warning and fault limits.

P2.7.2.9.7 Channel 2C Warn ID772

P2.7.2.9.8 Channel 2C Fault ID773

Second board third (2C) channel warning and fault limits.

6.7.3 FIELDBUS

2.7.3.1 Fieldbus Fault Slot D Response ID733

Set the response for a fieldbus fault if the active control place is fieldbus. For more information, see the relevant Fieldbus Board Manual.

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to Stop Function

2.7.3.2 FB WD Time

Delay time to a fieldbus fault when the pulse from PLC is missing. Setting the time to zero will disable the monitoring function.

6.7.4 OPT-D7 PROTECTIONS

2.7.4.1 THD Response ID1672

2.7.4.2 THD Warn. Limit ID1673

2.7.4.3 THD Fault Limit ID1674

2.7.4.4 HF rms Response ID1675

2.7.4.5 HF rms Warn Limit ID1676

2.7.4.6 HF rms Fault Limit ID1677

6.7.5 EXTERNAL FAULT

P2.7.5.1 Response to external fault 1 ID701

P2.7.5.2 Response to external fault 2 ID1504

This parameter defines a response to external fault 1 and 2t. If the drive monitors the state of external fault input (ID405 and ID406) and a fault occurs the drive can be set to respond to the fault.

0 = No response
1 = Warning
2 = Fault (the drive will stop modulation leaving MCB closed)

6.7.6 COOLING PROTECTION

Protection for liquid cooled units. An external sensor is connected to the drive (DI: Cooling Monitor) to indicate if cooling liquid is circulating.

P2.10.7.1 Cooling fault delay ID751 "Cooling F Delay"

This parameter defines the delay after which the drive goes to fault state when 'Cooling OK' signal is missing.

P2.10.7.2 Cooling fault response ID762 "CoolingFaultREsp"

In some cases it is more important to allow the drive to run even if the cooling liquid is not circulating. Then it is possible to select warning as the response. The drive will then continue running until its internal protection will stop it. If cooling signal loss happens on stop state indication is not stored to fault history if previous fault is already Cooling Fault. In Run State indication is always stored to fault history

0 = Stop State: No Action, Run State: Warning
1= Stop State: Warning, Run State: Warning
2= Stop State: Warning, Run State: Fault
3= Stop State: No Action, Run State: Fault

6.7.7 CABIN PROTECTION

P2.7.7.1 Klixon Response ID782

Select the response for klaxon inputs.

0 = No Action

1 = Warning, Warning

Both klixon inputs give a warning

2 = Warning, Fault

Klixon input 1 will generate warning and klixon input 2 will generate fault

3 = Fault, Fault

Both klixon inputs give a fault

P2.7.7.2 Ambient Temp Response ID784

Select the response for ambient temperature digital input.

P2.7.7.3 Input Switch Response ID785

Select the response for input switch digital input.

6.7.8 OPTIONS

2.7.6 Fault Simulation ID1569 "Fault Simulation"

With this parameter it is possible to simulate different faults without actually making, for example, an over current situation. In the point of view of the drive interface, the operation is identical to actual fault situation.

B00 = +1 = Simulates an over current fault (F1)
B01 = +2 = Simulates an over voltage fault (F2)
B02 = +4 = Simulates an under voltage fault (F9)
B03 = +8 = Simulates an output phase supervision fault (F11)
B04 = +16 = Simulates an earth fault (F3)
B05 = +32 = Simulates a system fault (F8)
This fault simulation covers a wide range of different faults in drive. See the fault description for details.
B06 = +64 = Free
B07 = +128 = Simulates an over temperature warning (W14)
B08 = +256 = Simulates an over temperature fault (F14)
The warning bit must be active for a fault to appear in simulation. If the fault bit is left active, the drive will go FAULT state at warning limit when the drive temperature rises to the warning level.
B09 = +512 = Reserved

2.7.7 Reset Datalogger ID1857

This parameter reset datalogger setting back to factory defaults.

6.8 FIELDBUS PARAMETERS

FBSpeedReference is used as DC Voltage Reference when control place is Fieldbus.
If FBSpeedRefernce is below 50,00 % keypad DC Voltage Reference is used. But is always limited to 105 %.

2.8.1 FB Actual Value Sel

Select ID for monitoring signal that will be located in FBSpeedActual.

2.8.2 - 2.8.9 Fieldbus data out 1-8 selection ID1490-ID1497

Using these parameters, you can monitor any monitoring or parameter value from the fieldbus. Enter the ID number of the item you wish to monitor for the value of these parameters.

2.8.10 - 2.8.17 Fieldbus data in 1-8 selection ID876-ID883

Using these parameters, you can control any parameter from the fieldbus. Enter the ID number of the item you wish to control for the value of these parameters.

2.8.18 GSW ID ID897

With this parameter it is possible to select which data is sent in FBGeneralStatusWord.

2.8.19 State Machine

The application provides a possibility to select what kind of state machine is used.
See details from chapter Status and Control Words in detail.

0: Basic
This mode makes fieldbus control behave as is explained in the fieldbus board manual.

1: Standard
A simple control word that is used in modes where the control word from fieldbus is used as such. For some fieldbus boards this requires a bypass operation.

2: Vacon AFE 1
This mode uses a ProfiDrive type state machine in the application level. You can use this mode on fieldbus boards that do not have a state machine or have a possibility to bypass the state machine function in the option board.

3: Vacon AFE 2
This mode uses a ProfiDrive type state machine in the application level. You can use this mode on fieldbus boards that do not have a state machine or have a possibility to bypass the state machine function in the option board. More extensive control than Vacon AFE 1 state machine selection.

P2.8.20 Control Slot selector ID1440 "ControlSlotSel."

This parameter defines which slot is used as the main control place when two fieldbus boards have been installed in the drive

6.9 ID FUNCTIONS

Here you will find the functions that use the parameter ID number to control and monitor the signal.

6.9.1 VALUE CONTROL

The value control parameters are used to control an input signal parameter.

P2.9.1.1 Control Input Signal ID ID1580 "ContrlnSignal ID"

With this parameter you can select which signal is used to control the selected parameter.

P2.9.1.2 Control Off Limit ID1581 "Contrl Off Limit"

This parameter defines the limit when the selected parameter value is forced to Off value.

P2.9.1.3 Control On Limit ID1582 "Contrl On Limit"

This parameter defines the limit when the selected parameter value is forced to On value.

P2.9.1.4 Control Off Value ID1583 "Contrl Off Value"

This parameter defines the value that is used when the used input signal is below Off limit.

P2.9.1.5 Control On Value ID1584 "Contrl On Value"

This parameter defines the value that is used when the used input signal is above On limit.

P2.9.1.6 Control Output Signal ID ID1585 "ContrlOutSignID"

This parameter defines which parameter is forced to On and Off values when selected input signal exceeds the set limits.

P2.9.1.7 Control Mode ID1586 "Control Mode"

This parameter defines how the value control output behaves.

0 = SR ABS

Absolute input value is used to make a step change in the output between On and Off values.

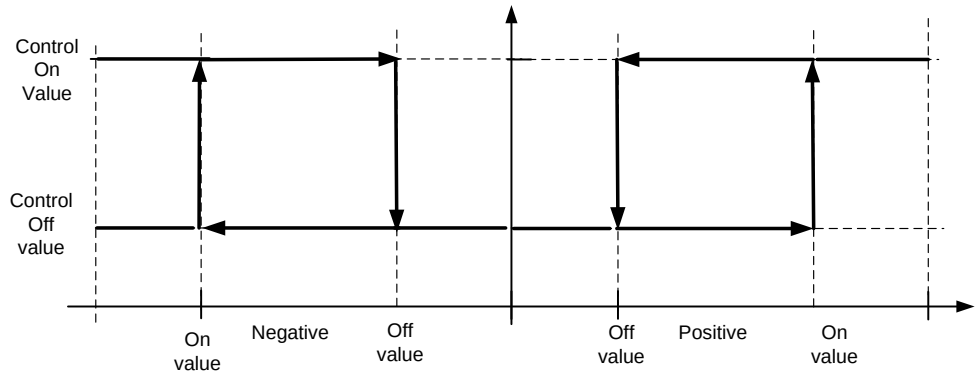


Figure 1.

1 = Scale ABS

Absolute input value is scaled linearly between On and Off values.

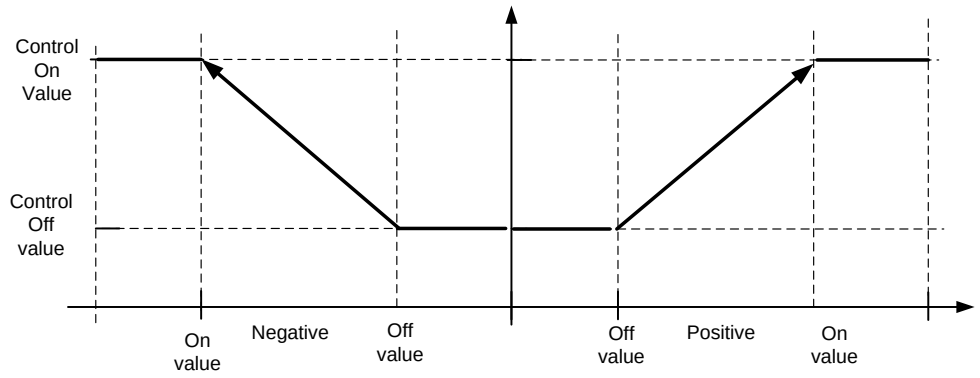


Figure 2.

2 = Scale ABS Inverted
Inverted absolute value is scaled linearly between On and Off values.

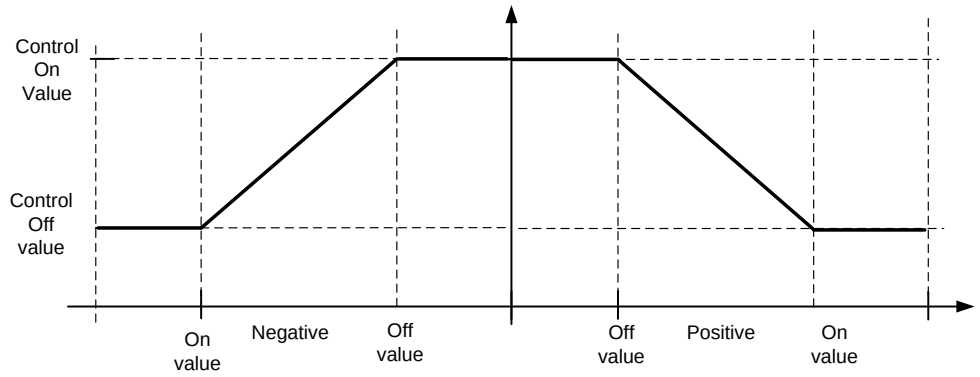


Figure 3.

3 = SR
Input value is used to make a step change in the output between On and Off values.
4 = Scale ABS
Input values is scaled linearly between On and Off values.
5 = Scale Inverted
Inverted value is scaled linearly between On and Off values

P2.9.1.8 Control Signal Filtering TC ID1721 "Control Filt TC"

This parameter is used to filter the scaling function output. This can be used, for example, when unfiltered torque is used to control a parameter that needs stabilisation.

6.9.2 DIN ID CONTROL

This function is used to control any parameter between two different values with a digital input. Different values are given for DI LOW and DI HIGH.

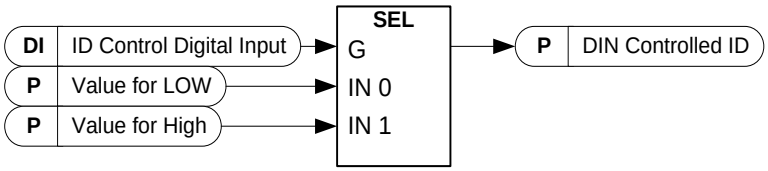


Figure 4.

P2.9.2.1 ID Control Digital Input ID1570 "ID Control DIN"

P2.9.3.1 ID Control Digital Input ID1590 "ID Control DIN"

P2.9.4.1 ID Control Digital Input ID1578 "ID Control DIN"

Select a digital input to be used for controlling the parameter selected by ID1571.

P2.9.2.2 DIN Controlled ID ID1571 "Controlled ID"

P2.9.3.2 DIN Controlled ID ID1575 "Controlled ID"

P2.9.4.2 DIN Controlled ID ID15719 "Controlled ID"

Select a parameter ID controlled by ID1570.

P2.9.2.3 Value for Low digital input (FALSE) ID1572 "FALSE Value"

P2.9.3.3 Value for Low digital input (FALSE) ID1592 "FALSE Value"

P2.9.4.3 Value for Low digital input (FALSE) ID15794 "FALSE Value"

Set the controlled parameter value when the digital input (ID1570) is LOW for the parameter selected by ID1571. The function does not recognise decimals. For example, give the value 10.00 Hz as *1000*.

P2.9.2.4 Value for High digital input (TRUE) ID1573 "TRUE Value"

P2.9.3.4 Value for High digital input (TRUE) ID1593 "TRUE Value"

P2.9.4.4 Value for High digital input (TRUE) ID1596 "TRUE Value"

Set the controlled parameter value when the digital input (ID1570) is HIGH for the parameter selected by ID1571. The function does not recognise decimals. For example, give the value 10.00 Hz as *1000*.

6.10 KEYPAD CONTROL

3.1 Control place ID125

The active control place can be changed with this parameter.

NOTE! Keypad is the default control place.

0 = PC Control, Activated by NCDrive
1 = I/O terminal
2 = Keypad
3 = Fieldbus
(4 = SystemBus**)**

On keypad control pressing Stop button more than a 2 second will open the MCB.

7. STATUS AND CONTROL WORDS IN DETAIL

P2.10.19 State machine	
0 / Basic	This mode makes fieldbus control behave as in explained in used fieldbus board manual.
1 / Standard	Simple control word that is used in modes where control word from fieldbus is used as such, for some fieldbus board this requires bypass operation.
2 / Vacon AFE 1	This mode uses ProfiDrive type state machine in application level. This mode is possible to use on fieldbus boards that does not have state machine itself or has possibility to bypass state machine functionality in option board.
3 / Vacon AFE 2	This mode uses ProfiDrive type state machine in application level. This mode is possible to use on fieldbus boards that does not have state machine itself or has possibility to bypass state machine functionality in option board.

8.1 BASIC IN BYPASS (0)

	FB Control Word ID1160	
	Signal	Description
B00	Run	**0**= AFE is stopped **1**= AFE is started
B01		
B02	Fault Reset	0>1 Reset fault.
B03	FB DIN1	Can be used to control RO or directly parameter by ID number. G2.4.1
B04	FB DIN2	Can be used to control RO or directly parameter by ID number. G2.4.1
B05	FB DIN3	Can be used to control RO or directly parameter by ID number. G2.4.1
B06	FB DIN4	Can be used to control RO or directly parameter by ID number. G2.4.1
B07	FB DIN5	Can be used to control RO or directly parameter by ID number. G2.4.1
B08		
B09		
B10		
B11		
B12		
B13		
B14		
B15		

8.2 FB CONTROL WORD

8.2.1 STANDARD (1)

	FB Control Word ID1160	
	Signal	Comment
B00	DC Charge	**0**= Open MCB. **1**= Close DC charge. MCB closed automatically.
B01		
B02		
B03	Run	**0**= AFE is stopped **1**= AFE is started
B04		
B05		
B06		
B07	Reset	0>1 Reset fault.
B08		
B09		
B10		
B11	FB DIN1	Can be used to control RO or directly parameter by ID number. G2.4.1
B12	FB DIN2	Can be used to control RO or directly parameter by ID number. G2.4.1
B13	FB DIN3	Can be used to control RO or directly parameter by ID number. G2.4.1
B14	FB DIN4	Can be used to control RO or directly parameter by ID number. G2.4.1
B15		

B00: FALSE = Open MCB, TRUE = PreCharge DC
Open MCB: Opens MCB if closed, stops precharging if not closed.
PreCharge DC: Drive will start precharge if function activated by digital output and control place is fieldbus. When control place is not fieldbus precharging is started from normal start command.

B03: FALSE = Stop Request, TRUE = Start Request
Stop Request: Drive will stop .
Start Request: Start Command to the drive. Rising edge needed for start.

B07: FALSE = No significance, TRUE = Fault Acknowledge

Fault Acknowledge: The group signal is acknowledged with a positive edge.

8.2.2 VACON AFE 1 PROFILE (2)

	FB Control Word ID1160	
	Signal	Comment
B00	DC Charge	**0**= Open MCB. **1**= Close DC charge contactor, MCB closed automatically.
B01		
B02		
B03	Run	**0**= AFE is stopped **1**= AFE is started
B04		
B05		
B06		
B07	Reset	0>1 Reset fault.
B08	DC Voltage Ref B00	B00 | B01 **0 | 0** = FB Reference. P2.2.1, if not FB Control & FB Ref > 50,00 % **0 | 1** = 110 % **1 | 0** = 115 % **1 | 1** = 120 %
B09	DC Voltage Ref B01	
B10	Fieldbus Control	**0**= No control from fieldbus **1**=Control from fieldbus
B11	Watchdog	0>1>0>1…0,5 sec square wave clock. This is used to check data communication between fieldbus master and the drive.
B12	FB DIN2	Can be used to control RO or directly parameter by ID number. G2.4.1
B13	FB DIN3	Can be used to control RO or directly parameter by ID number. G2.4.1
B14	FB DIN4	Can be used to control RO or directly parameter by ID number. G2.4.1
B15		Reserved for future use.

B00: FALSE = Open MCB, TRUE = PreCharge DC
Open MCB: Opens MCB if closed, stops precharging if not closed.
PreCharge DC: Drive will start precharge if function activated by digital output and control place is fieldbus. When control place is not fieldbus precharging is started from normal start command.

B03: FALSE = Stop Request, TRUE = Start Request
Stop Request: Drive will stop .
Start Request: Start Command to the drive. Rising edge needed for start.

B07: FALSE = No significance, TRUE = Fault Acknowledge

Fault Acknowledge: The group signal is acknowledged with a positive edge.

B08: FALSE = No Function, TRUE = DC Ref 1

B09: FALSE = No Function, TRUE = DC Ref 2

DC Ref	FB Reference	110,00 %	115,00 %	120,00 %
B08	FALSE	TRUE	FALSE	TRUE
B09	FALSE	FALSE	TRUE	TRUE

B10: FALSE = FB Control disabled TRUE = FB Control Enabled

FB Control Disabled: Drive will not follow main control word from Fieldbus. If removed while running drive will stop.
FB Control Enabled: Drive follows control word from fieldbus

B11: FALSE = FB WD Pulse Low, TRUE = FB WD Pulse High

Watch Dog pulse: This pulse is used to monitor that PLC is alive. If pulse is missing drive will go to fault state. This function is activated by P2.7.6 FB WD Delay. When value is zero pulse si not monitored.

8.2.3 VACON AFE 2 PROFILE (3)

	FB Control Word ID1160	
	Signal	Comment
B00	DC Charge	**0**= Open MCB. **1**= Close DC charge contactor, MCB closed automatically, see B01.
B01	MCB Close Enable	**0**= Disable Closing of MCB (Also opens if Control Options.B0=TRUE) **1**= Enable Closing of MCB (Works also for reclosing)
B02	Quick Stop	**0**= Quick Stop **1**= No Quick Stop
B03	Run	**0**= AFE is stopped **1**= AFE is started
B04	Output Power Limit to Zero	**0**= Output Power Limit to Zero (7%) **1**= Output Power Limit = P2.5.2.1
B05	Disable Power Increase. Input or Output	**0**= Disable increase of power. **1**= Power limits defined by G2.5.2
B06	Input Power Limit to Zero	**0**= Input Power Limit to Zero (7%) **1**= Output Power Limit = P2.5.2.2
B07	Reset	0>1 Reset fault.
B08	DC Voltage Ref B00	B00 | B01 **0 | 0** = FB Reference. P2.2.1, if not FB Control & FB Ref > 50,00 % **0 | 1** = 110 % **1 | 0** = 115 % **1 | 1** = 120 %
B09	DC Voltage Ref B01	
B10	Fieldbus Control	**0**= No control from fieldbus **1**=Control from fieldbus
B11	Watchdog	0>1>0>1…0,5 sec square wave clock. This is used to check data communication between fieldbus master and the drive.
B12	FB DIN2	Can be used to control RO or directly parameter by ID number. G2.4.1
B13	FB DIN3	Can be used to control RO or directly parameter by ID number. G2.4.1
B14	FB DIN4	Can be used to control RO or directly parameter by ID number. G2.4.1
B15		Reserved for future use.

B00: FALSE = Open MCB, TRUE = PreCharge DC
Open MCB: Opens MCB if closed, stops precharging if charging is active trough the drive.
PreCharge DC: Drive will start precharge if function activated by digital output and control place is fieldbus. When control place is not fieldbus precharging is started from normal start command.

B01: MCB Close Enable

FALSE: MCB Closing is disabled in fieldbus control. MCB Remains open when if DC voltage is above closing limit.
TRUE: MCB Closing is enabled in fieldbus control. This bit can be true all the time if function is not needed.

B02: Quick Stop

FALSE: Drive will stop modulation immediately and open MCB immediately.
TRUE: Quick stop is not active and normal operation is possible.

B03: FALSE = Stop Request, TRUE = Start Request
Stop Request: Drive will stop .
Start Request: Start Command to the drive. Rising edge needed for start.

B04: Output Power Limit to Zero
FALSE: Output power limit is reduced to 7 % if parameter limit is higher.
TRUE: Power limit is defined by power limit parameters.

B05: Disable Power Increase. Input or Output
FALSE: Power is limited to actual power, power can't increase when this bit is active,
TRUE: Power limit is defined by power limit parameters.

B06: Input Power Limit to Zero
FALSE: Input power limit is reduced to 7 % if parameter limit is higher
TRUE: Power limit is defined by power limit parameters.

B07: FALSE = No significance, TRUE = Fault Acknowledge

Fault Acknowledge: The group signal is acknowledged with a positive edge.

B08: FALSE = No Function, TRUE = DC Ref 1

B09: FALSE = No Function, TRUE = DC Ref 2

DC Ref	FB Reference	110,00 %	115,00 %	120,00 %
B08	FALSE	TRUE	FALSE	TRUE
B09	FALSE	FALSE	TRUE	TRUE

B10: FALSE = FB Control disabled TRUE = FB Control Enabled

FB Control Disabled: Drive will not follow main control word from Fieldbus. If removed while running drive will make coasting stop.
FB Control Enabled: Drive follows control word from fieldbus

B11: FALSE = FB WD Pulse Low, TRUE = FB WD Pulse High

Watch dog pulse: This pulse is used to monitor that PLC is alive. If pulse is missing drive will go to fault state. This function is activated by P2.7.6 FB WD Delay. When value is zero pulse si not monitored.

8.3 FB STATUS WORD

	FB Status Word ID68	
	Signal	Comment
b0	Ready On	0=Drive not ready to switch on 1=Drive ready to start charging
b1	Ready Run	0=Drive not ready to run 1=Drive ready and MCB is ON
b2	Running	0=Drive not running 1=Drive in Run state (Modulating)
b3	Fault	0=No active fault 1=Fault is active
b4	Run Enable Status	0= Run Disabled. Drive in stop state 1= Run Enabled. Drive can be started.
b5	Quick Stop Active	0=Quick Stop Active 1=Quick Stop not Active
b6	MCB Control OK	0= Status opposite of control 1= Status and control OK
b7	Warning	0= No active warnings 1= Warning active
b8	At Reference	0= DC Voltage Ref and Act DC Voltage are not same.
b9	Fieldbus Control Active	0=Fieldbus control not active 1=Fieldbus control active
b10	Above Limit	0= DC Voltage is below P2.5.5.1 level 1=The DC Voltage is above the P2.5.5.1 level
b11	MCB Control (DO Final)	0= Drive is controlling MCB to be Open. 1= Drive is controlling MCB to be Closed
b12	MCB Feedback	0= Feedback indicates MCB to be Open 1= Feedback indicates MCB to be Closed
b13		Reserved for future use.
b14	DC Charge DO Control	0= DC not charged 1= DC Charging Active
b15	Watchdog	Same as received on bit 11 of the main control word.

B00: FALSE = Not Ready to Switch On, TRUE = Ready to Switch On
Not Ready to Switch On: Fault active, DI: Run Enable low, MCB Forced open command active, Quick Stop Active.
Ready to Switch On: No Faults, DI: Run Enabled, DI: MCB not forced open, Quick Stop not active.

B01: FALSE = Not Ready To Operate, TRUE = Ready To Operate
Not Ready To Operate: CW.B0 = FALSE, DC Not Ready, MCB Control Open, MCB Status Low.
Ready To Operate: CW.B0 = TRUE, DC Ready, MCB Control closed, MCB Status High.

B02: FALSE = Drive is not operating, TRUE = Drive is operational
Drive is not operating: Drive is not run state (modulating)
Drive is operational: Drive is in run state and modulating.

B03: FALSE = No Fault, TRUE = Fault Present
No Fault: Drive is not on fault state.
Fault Present: Drive is in fault state.

B04: FALSE = Coast Stop Activated, TRUE = Coast Stop Not Activated
Coast Stop Activated: DI: Run Enable False, Quick Stop Active, MCB Status Open, MCB Control Open, Enable MCB Close, MCB Forced Open.
Coast Stop Not Activated: Running Enabled

B05: FALSE = Quick Stop Activated, TRUE = Quick Stop Not Activated
Quick Stop Activated: Quick Stop command is active.
Quick Stop Not Activated: Quick stop command is not active.

B06: FALSE = MCB Control OK, TRUE = MCB Control Not OK
MCB Control OK: MCB Control and Drive internal status are the same.
MCB Control Not OK: Drive internal status to close the MCB is high but application logic request MCB open. This can be case when MCB has been opened but DC is connected to battery system. DC needs to be discharged or MCB is needed to close.

B07: FALSE = No Warning, TRUE = Warning Present
No Warning: There is no warning or the warning has disappeared again.
Warning Present: Drive still works; warning in the service/maintenance parameter;
no acknowledgement.

B08: FALSE = DC Voltage out of tolerance TRUE = DC Voltage within tolerance
DC Error Out Of Tolerance Range:
DC Error Within Tolerance Range:

B09: FALSE = No Control Requested, TRUE = Control Requested
No Control Requested: Control by the automation system is not possible.
Control Requested: The automation system is controlling.

B10: FALSE = DC Not Reached, TRUE = DC Reached Or Exceeded
DC Not Reached: DC Voltage is below P2.5.5.1 level
DC Reached Or Exceeded: DC Voltage is above the P2.5.5.1 level

B11: MCB Control (DO Final)
FALSE: Drive is controlling MCB to be Open.
TRUE: Drive is controlling MCB to be Closed

B12: MCB Feedback
FALSE: Feedback indicates MCB to be Open
TRUE: Feedback indicates MCB to be Closed

B14: FALSE = Charge DO Open, TRUE = Charge DO Closed
Charge DO Open: Charging Command not active
Charge DO Closed: Charging Command Active

B15: FALSE = FB DW Feedback Low, TRUE = FB DW Feedback High
FB DW Feedback: FB Control Word B11 is echoed back to the Fieldbus. Can be used to monitor communication status from the drive.

7.11 FAULT WORD 1

	Fault Word 1 ID1172
Bit	Fault(s)
B0	F1 Over current, F31 IGBT, F41 IGBT

B1	F2 Over Voltage
B2	F9 Under Voltage
B3	F91 Short Circuit
B4	F3 Earth Fault
B5	
B6	F14 Unit Over Temperature
B7	F29 Thermistor, F56 Measured Temperature 1, F65 Measured Temperature 2 F71 LCL Over Temperature
B8	F10 Line Synch fault F11 Supply Phase
B9	
B10	Device faults: F37, F38, F39, F40
B11	
B12	
B13	
B14	
B15	

7.12 FAULT WORD 2

	Fault Word 2 ID1173
Bit	Fault(s)
B0	
B1	F5 Charging Fault, F80 Charge Fault
B2	
B3	Hardware faults: F7
B4	F13 Under Temperature
B5	F22 EPROM, F49 Zero Division
B6	
B7	
B8	
B9	F31 IGBT, F41 IGBT
B10	
B11	F32 Fan Fault, F70 LCL Fan Fault
B12	
B13	F8 System, F26 Start Up Prevented, F36 Control Unit
B14	F64 MCB State Fault
B15	

7.13 WARNING WORD 1

	Warning Word 1 ID1174
Bit	Warning(s)
B0	
B1	W29 Thermistor F56 Measured Temperature 1, F65 Measured Temperature 2 F71 LCL Over Temperature
B2	
B3	W11 Supply Phase
B4	
B5	
B6	
B7	
B8	W14 Unit Over Temperature
B9	
B10	F32 Fan Fault, F70 LCL Fan Fault, F60 Cooling Fault
B11	
B12	
B13	
B14	
B15	

Table 8. Alarm Word 1

8.4 AUXILIARY CONTROL WORD

	FALSE	TRUE
b0		Reserved for future use.
b1		Reserved for future use.
b2		Reserved for future use.
b3		Reserved for future use.
b4		Reserved for future use.
b5		Reserved for future use.
b6		Reserved for future use.
b7		Reserved for future use.
b8		Reserved for future use.
b9		Reserved for future use.
b10		Reserved for future use.
b11		Reserved for future use.
b12		Reserved for future use.
b13		Reserved for future use.
b14		Reserved for future use.
b15		Reserved for future use.

8.5 STATUS WORD (APPLICATION) ID 43

Application Status Word combines different drive statuses to one data word.

	Application Status Word ID43	
	FALSE	TRUE
b0		
b1	Not in Ready state	Ready
b2	Not Running	Running
b3	No Fault	Fault
b4		
b5		
b6	Run Disabled	Run Enable
b7	No Warning	Warning
b8		Charging Switch closed (internal)
b9		MCB Control (DO Final)
b10		MCB Feedback
b11		DO Charging Active
b12	No Run Request	Run Request
b13		
b14		
b15		

B01: FALSE = Not Ready, TRUE = Ready
Not Ready: DC Voltage low, Fault active
Ready: Drive in ready state, start command can be given.

B02: FALSE = Not Running, TRUE = Running
Not Running: Drive is not modulating
Running: Drive is modulating.

B03: FALSE = No Fault, TRUE = Fault Active
No Faults: Drive do not have active faults.
Fault: Drive has an active faults.

B06: FALSE = Run Enable Low, TRUE = Run Enable High
Run Enable Low: Run Enable command to motor control is low
Run Enable High: Run Enable command to motor control is high.

B07: FALSE = No Warning, TRUE = Warning Active
No Warning: No warning signals active in the drive
Warning: Drive has active warning signal. Warning signal not stop the operation.

B08: FALSE = Charging Switch Open, TRUE = Charging Switch closed
Charging Switch Open: DC voltage level is nor reached closing level or has drop below the opening level. This information is from drive motor control.
Charging switch Closed: DC voltage level is above closing limit and no interlock active internally.

B09: FALSE = MCB Open command, TRUE = MCB closed command
MCB Open Command: Final command to open the MCB from application logic.

MCB Close Command: Final close command to MCB from application logic.

B10: FALSE = Main contactor Open, TRUE = Main contactor closed
MCB Open: Feedback from MCB, open.
MCB Closed: Feedback from MCB, closed.

B11: FALSE = Charge Control Open, TRUE = Charge Control Closed
Charge Control Open: Charging Contactor is not controlled.
Charge Control Closed: Charging contactor controlled closed.

B12: FALSE = No Run Request, TRUE = Run Request
No Run Request: Final Run Request command has not been given to motor control.
Run Request: Final Run Request command has been given to motor control.

8. PROBLEM SOLVING

While proper information is needed form the problem, it's also recommended to try with latest application- and system software versions available. Software is continuously developed and default settings are improved (See Chapter 1.1 Compatibility issues in parameters between versions).

Type	Signal Name	Actual	Unit
Value	Status Word	22374	
Value	DC Voltage	575	V
Value	Active Current	-9,8	%
Value	Reactive Current	-49,6	%
Value	Current	351	A
Value	Supply Frequency	50	Hz
Value	Supply Voltage	248,3	V
Value	DIN Status 1	56	

Figure 5. The recommended signals for NCDrive

Use the fastest communication speed (Baudrate: 57 600) and a 50 ms update interval for signals for the RS232 communication.

For the CAN communication, use a 1 Mbit communication speed and 7 ms update interval for signals.

When you contact the support, send the *.trn, *.par and Service info (*.txt) files with a description of the situation. If the situation is caused by a fault, take also the Datalogger data from the drive.

Note that Datalogger settings can be changed to catch correct situation and it's also to possible make manual force trig for Datalogger.

Before storing the parameter file, upload the parameters from the drive and save when NCDrive is in the ON-LINE state. If it is possible, do this while the problem is active.

It's also helpful to have single line diagram from the system where problem is faced.

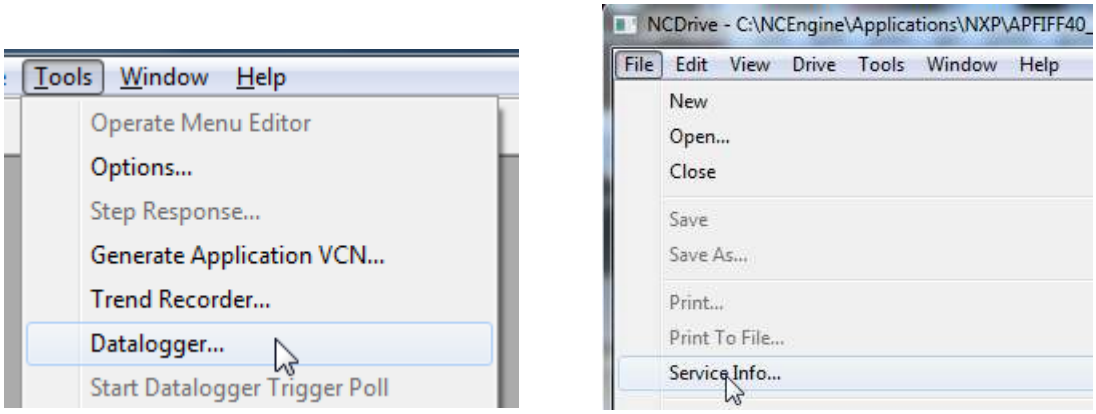


Figure 1. Datalogger window opening and Service Info upload.

9. FAULT CODES

The fault codes, their causes and correcting actions are presented below.

Note: When contacting distributor or factory because of a fault condition, always write down all texts and codes on the keypad display. Best way is to send parameter file and service info to Vacon technical support
This chapter includes all fault codes that are possible. but some faults are not possible in AFE application. And some faults description may be different when compared to standard frequency converter.

F1 Over current fault

Drive has detected a high current in the output phase.

S1 = Hardware trip:
Current above 4*Ih

Possible cause and solutions

1. Sudden increase in load
   - Check motor load.
2. Short circuit in cables
   - Check cables.

F2 Overvoltage fault

DC-link voltage has exceeded the drive protection limits.

S1 = Hardware trip.
500 Vac unit DC voltage above 911 Vdc
690 Vac unit DC voltage above 1200 Vdc
S2 = Overvoltage control supervision (only 690 Vac unit).
DC voltage has been above 1100 Vdc for too long.

Possible cause and solutions

1. Too short a deceleration time
   - Increase deceleration time.
   - Use brake chopper and brake resistor.
   - Use Brake chopper unit.
2. High overvoltage spikes in supply
   - Check input voltage.

F3 Earth fault

Earth fault protection ensures that the sum of the phase currents is zero. The over current protection is always working and protects the frequency converter from earth faults with high currents.

S1 = Sum of output phase current is not zero

Possible cause and solutions

1. Insulation failure in cables

F5 Charge switch

Charge switch status is not correct when start command is given.

S1 = Charge switch was open when START command was given.

Possible cause and solutions

2. Charge switch was open when the START command was given.
    - Check connection of the feedback from charging relay
3. Reset the fault and restart.

Should the fault re-occur, contact your local distributor.

F7 Saturation fault

S1 = Hardware failure

- Cannot be reset from the keypad.
- Switch off power.
- DO NOT RE-CONNECT POWER!
- Contact your local distributor.

F8 System Fault

A system fault indicates several different fault situations in drive operation.

S1 = Reserved

4. Disturbance. Reset the unit and try again.
5. If there is star coupler in the unit, check the fibre connections and phase order.
6. Driver board or IGBT broken.
7. FR9 and the bigger size drives , which includes not star coupler, ASIC board (VB00451) is broken.
8. FR8 and smaller size drives: control board broken.
9. FR8 and smaller size drives: if there is boardsVB00449 / VB00450 in use,failure might be in there.

S2 = Reserved
S3 = Reserved
S4 = Reserved
S5 = Reserved
S6 = Reserved
S7 = Charge switch
S8 = No power to driver card
S9 = Power unit communication (TX)
S10 = Power unit communication (Trip)
S11 = Power unit comm. (Measurement)
S12 = SystemBus synchronization has failed in DriveSynch operation
S30 = Safe disable inputs are in different state (OPT-AF)
S31 = Thermistor short circuit detected (OPT-AF)
S32 = OPT-AF board has been removed
S33 = OPT-AF board EEPROM eror

F9 Undervoltage fault

DC-link voltage is below the fault voltage limit of the drive.

S1 = DC-link too low during run
S2 = No data from power unit
S3 = Undervoltage control supervision

Possible cause
1. Too low a supply voltage
2. Frequency converter internal fault
3. One of the input fuses is broken.
4. External charge switch has not been closed.

Correcting measures
1. In case of temporary supply voltage break, reset the fault and restart the frequency converter.
2. Check supply voltage.
3. Check function of DC charge.
4. Contact your local distributor.

F10 Line Synchronization Fault

S1 = Phase supervision diode supply
S2 = Phase supervision active front end

Possible cause:
1. Input line phase is missing.

Correcting measures
1. Check supply voltage, fuses and cable.

F11 Line phase supervision

Current measurement has detected that there is no current in one phase or one phase current is considerably different from other phases.

Correcting measures
1. Check cables

F13 Drive under temperature fault

Possible cause:
1. Heatsink temperature is under –10°C

F14 Drive over temperature fault

Possible cause:
1. Heatsink temperature is over acceptable limits. See user's manual for the temperature limit. Overtemperature warning is issued before actual trip limit is reached.

Correcting measures
1. Check correct amount and flow of cooling air.
2. Check the heatsink for dust.
3. Check ambient temperature.
4. Make sure that switching frequency is not too high in relation to ambient temperature and motor load.

F22 EEPROM checksum fault

Possible cause:

1. Parameter save fault
2. Faulty operation
3. Component failure

Correcting measures:

1. Should the fault re-occur, contact your local distributor.

F24 Counter fault

Possible cause:

1. Values displayed on counters are incorrect

Correcting measures:

1. Have a critical attitude towards values shown on counters.

F25 Microprosessor watchdog fault

Possible cause:

1. Start-up of the drive has been prevented.
2. Run request is ON when a new application is loaded to the drive.

Correcting measures:

1. Reset the fault and restart.
2. Should the fault re-occur, contact your local distributor.

F26 Start-Up prevention

Possible cause:

1. Start-up of the drive has been prevented.
2. Run request is ON when a new application is loaded to drive

Correcting measures:

1. Cancel prevention of start-up if this can be done safely.
2. Remove Run Request.

F29 Thermistor fault

The thermistor input of the option board has detected too high a motor temperature.

Possible cause:

1. Motor is overheated.
2. Thermistor cable is broken.

Correcting measures:

1. Check motor cooling and load
2. Check thermistor connection(If thermistor input of the option board is not in use it has to be short circuited).

F31 IGBT temperature

IGBT Inverter Bridge over temperature protection has detected too high a short term overload current.

Possible cause:

1. Too high load
2. Identification run has not been made which causes the motor to start under magnetized.

Correcting measures:

1. Check load.
2. Check motor size.
3. Make identification Run.

F32 Fan cooling

Possible cause:

1. Cooling fan of the frequency converter does not start when ON command is given.

Correcting measures:

1. Contact your local distributor.

F37 Device change

Option board or power unit changed.

Possible cause:

1. New device of same type and rating.

Correcting measures:

1. Reset. Device is ready for use.

F38 Device added

Option board added.

Correcting measures:

1. Reset. Device is ready for use. Old board settings will be used.

F39 Device removed

Option board removed.

Correcting measures:

1. Reset. Device no longer available.

F40 Device unknown

Unknown option board or drive.

S1 = Unknown device
S2 = Power1 not same type as Power2

Correcting measures:

1. Contact the distributor near to you.

F41 IGBT temperature

IGBT inverter bridge over temperature protection has detected too high a short term overload current.

Correcting measures:

1. Check load.

F44 Device changed (Default param.)

Possible cause:

1. Option board or power unit changed.
2. New device of different type or different rating from the previous one.

Correcting measures:

1. Reset
2. Set the option board parameters again if option board was changed. Set converter parameters again if power unit was changed.

F45 Device added (default param.)

Possible cause:

1. Option board of different type added.

Correcting measures:

1. Reset
2. Set the option board parameters again.

F50 4mA supervision

Possible cause:

1. Current at the analogue input is below 4mA.
2. Signal source has failed
3. Control cable is broken or loose

Correcting measures:

1. Check the current loop circuitry.

F51 External fault

Possible cause:

1. Digital input fault.

Correcting measures:

1. Remove fault situation from external device.

F52 Keypad communication

Possible cause:

1. The connection between the control keypad or NCDrive and the AC drive is broken.

Correcting measures:

1. Check keypad connection and possible keypad cable.

F53 Fieldbus communication Slot D

Possible cause:
1. The data connection between the fieldbus Master and the fieldbus board is broken.

Correcting measures:
1. Check installation.
2. If installation is correct contact the nearest Vacon distributor.

F54 Slot fault

Possible cause:
1. Defective option board or slot

Correcting measures:
1. Check board and slot.
2. Contact the nearest Vacon distributor.

F55 Input Switch

Possible cause:
1. Digital input monitoring indicates that DC or AC input switch is open

Correcting measures:
- Check reason for open input switch.

F56 Temperature sensor board 1 fault

Temperature protection function is used to measure temperature and give warning and/or fault when set limits are exceeded. AFEII application supports two temperature sensor boards simultaneously.

A1 – Temperature limit has been exceeded.
A2 – Sensor not wired or not working.
A3 – Short circuit.

Possible cause:
1. Temperature limit values set for the temperature board parameters have been exceeded

Correcting measures:
- Find the cause of temperature rise
- Check sensor wiring

F60 Cooling

Protection for the liquid-cooled units. An external sensor is connected to the drive (DI: Cooling Monitor) to indicate if cooling liquid is circulating. If the drive is in Stop state only a warning is issued. In Run state a fault is issued and the drive makes a coast stop.

Possible cause:
1. Liquid cooled drive cooling circulation have been failed

Correcting measures:
1. Check reason for cooling failure from external system.

F62 Run Disabled

Run Disable warning signal is issued when Run Enable signal has been removed from the IO.

F64 MCB State Fault

A1: Code given by V002 and older versions.
A2: MCB open, while command is to close.
A3: MCB closed, while command is to open.
A4: MCB opened externally while AFE unit was in run state.
A5: MCB Trip state, Digital input from the MCB

Possible cause:

1. MCB has opened while drive controls it to close.
2. MCB is closed while drive controls it open.
3. MCB is opening while AFE unit is in Run state.

Correcting measures:

1. Check the MCB functionality

F65 Temperature sensor board 2 fault

Temperature protection function is used to measure temperature and give warning and/or fault when set limits are exceeded. AFEII application supports two temperature sensor boards simultaneously.

A1 – Temperature limit has been exceeded.
A2 – Sensor not wired or not working.
A3 – Short circuit.

Possible cause:
2. Temperature limit values set for the temperature board parameters have been exceeded

Correcting measures:

- Find the cause of temperature rise
- Check sensor wiring

F66 Klixon

Possible cause:

1. Klixon type temperature sensor has exceeded the triggering limit.

Correcting measures:

- Check reason for temperature trip where klixon sensor is located.

F67 Fieldbus communication Slot E

Possible cause:

1. The data connection between the fieldbus Master and the fieldbus board is broken.

Correcting measures:

1. Check installation.
2. If installation is correct contact the nearest Vacon distributor.

F70 LCL Fan Fault

Digital input connected to LCL indicates fan fault.

F71 LCL Temperature

LCL Temperature has reached warning limit.
Possible cause:
Correcting measures:

F80 Charging Fault

The drive has not reached need DC voltage at set time to MCB.

Possible cause:

1. Charging circuit not operational.
2. High load in DC link.
3. Low voltage in supply for charging circuit.

Correcting measures:

1. Check charging current

F81 Main Fuse

Possible cause:

1. Digital input fault.

Correcting measures:

1. Remove fault situation from external device.

F82 Aux Voltage

Possible cause:

1. Digital input fault.

Correcting measures:

1. Remove fault situation from external device.

F83 Safe Stop

Possible cause:

1. Digital input fault.

Correcting measures:

1. Remove fault situation from external device.

F84 Insulation

Possible cause:

1. Digital input fault.

Correcting measures:

1. Remove fault situation from external device.

F85 Earth Switch fault

Possible cause:

1. Digital input fault.

Correcting measures:

1. Remove fault situation from external device.

F86 Arc Relay

Possible cause:
1. Digital input fault.

Correcting measures:
1. Remove fault situation from external device.

F88 High Amb Temperature

Possible cause:
1. Digital input fault.

Correcting measures:
1. Remove fault situation from external device.

F89 Leakage fault

Possible cause:
1. Digital input fault.

Correcting measures:
1. Remove fault situation from external device.

F92 Supply Voltage

Supply voltage is not inside of set limits.

F94 External Fault 2

Possible cause:
2. Digital input fault.

Correcting measures:
2. Remove fault situation from external device.

F95 Line THD

Possible cause:
1. Line THD is too high

F96 Line HF Voltage

Possible cause:
1. Line HF Voltage is too high

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