ALC 11 – PCP

CFW-11 – ARTIFICAL LIFT DRIVE

ALC11 User´s Manual – Progressive Cavity Pump

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Summary of Reviews

The information below describes the revisions in this manual.

Reviews	Description	Author	Date
00	Initial emission	DDP	01/21/2021
01	Addition of new parameters for EAX1 reserve input alarms and speed reading parameter via digital sensor.	DDP	06/30/2021
02	Downhole sensor via Modbus communication included	DDP	03/14/2022

QUICK REFERENCE OF PARAMETERS / COMMUNICATION TABLE

Parameter	Address	Description	Status	Size	Default	Min.	Max.	Unit
Local Mode								
M0111	4x0112	Rod speed for local VSD operation (RPM on the rod)	- - -	16bits/INT	- - -	0	5000	RPM
M0195	4x0196	Control Word	10 = Command code for selecting Local mode on the frequency inverter 11 = Command code for selecting Remote mode on the frequency inverter 23 = Stops the pumping unit	16bits/INT	0	0	32767	- - -
Remote Mode								
R0005	0x0006	Selects the selection mode of the automatic/manual mode	ON = Operation as a toggle switch between manual and automatic modes OFF = Operation as pushbutton	8bits/Bool	ON	OFF	ON	- - -
R0217	0x0218	Selects the manual remote operating mode	- - -	8bits/Bool	OFF	OFF	ON	- - -
R0218	0x0219	Selects the automatic remote operating mode	- - -	8bits/Bool	OFF	OFF	ON	- - -
M0195	4x0196	Modbus Commands	52 = Command to start the pumping unit 53 = Command to stop the pumping unit	16bits/INT	0	0	32767	- - -
M0110	4x0111	Speed reference	- - -	16bits/INT	- - -	0	5000	RPM
D0019	4x10039	Maximum RPM value of the pumping unit	- - -	32bits/Float	1500.0	1.0	5000.0	RPM
D0018	4x10037	Minimum RPM value of the pumping unit	- - -	32bits/Float	50.0	1.0	5000.0	RPM
D0028	4x10057	Minimum motor speed	- - -	32bits/Float	30	20	300	Hz
D0029	4x10059	Maximum motor speed	- - -	32bits/Float	72	20	300	Hz
Automatic Control Strategy								
R0121	0x0122	Selection type automatic / manual mode	ON = Key, OFF = Pushbutton (local/remote) selection	8bits/Bool	OFF	OFF	ON	- - -
R0215	0x0216	Command reverses manual / automatic operating mode (T50 panel)	- - -	8bits/Bool	OFF	OFF	ON	- - -
M0020	4x0021	Control Strategy	0 = None 1 = PID 10 = Step control	16bits/INT	0	0	10	- - -
R0023	0x0024	Reverse and direct	OFF = Step control reverse, ON = Step control direct	8bits/Bool	OFF	OFF	ON	- - -
M0021	4x0022	Step interval (time between increments)	- - -	16bits/INT	5	0	200	s
D0007	4x10015	Control Set Point (Step Control or PID)	- - -	32bits/Float	(D0015+ D0016)	D0015	D0016	psi
D0043	4x10087	Hysteresis (% range where control does not act)	- - -	32bits/Float	5.0	0.0	30.0	%
D0044	4x10089	Step size (increment / decrement size in rod RPM)	- - -	32bits/Float	1.0	0.0	20.0	Rod RPM
D0015	4x10031	Minimum alarm limit for downhole pressure	- - -	32bits/Float	1.0	1.0	10000.0	psi
D0016	4x10033	Maximum alarm limit for downhole pressure	- - -	32bits/Float	1000.0	1.0	10000.0	psi

Parameter	Address	Description	Status	Size	Default	Min.	Max.	Unit
D0021	4x10043	PID proportional gain	- - -	32bits/Float	0.1	0.0	1000.0	- - -
D0022	4x10045	PID integral term	- - -	32bits/Float	5.0	0.001	50000.0	- - -
D0023	4x10047	PID derivative term	- - -	32bits/Float	0.0	0.0	1000.0	- - -
System Start								
M0008	4x0009	Delay to start the pump after energizing or resetting the controller	- - -	16bits/INT	RTC Seconds (0..59)	0	60	s
M0016	4x0017	Acoustic signal time before starting the motor	- - -	16bits/INT	0	0	60	s
Rocking start								
R0013	0X0014	Enables the pump rocking start	ON = Enable	8bits/Bool	OFF	OFF	ON	
R0127	0x0128	Active rocking start	ON = In test procedure for pump rocking start	8bits/Bool	OFF	OFF	ON	
R0128	0x0129	Rocking start completed successfully	ON = Pump rocking start test carried out with SUCCESS	8bits/Bool	OFF	OFF	ON	
M0040	4X0041	Spinning time in the operation direction	- - -	16bits/INT	5	1	60	s
M0043	4X0044	Motor speed in the operation direction	- - -	16bits/INT	10	10	300	RPM
M0041	4X0042	Spinning time in the opposite direction of the operation	- - -	16bits/INT	5	1	60	s
M0044	4X0045	Motor speed in the opposite direction of the operation	- - -	16bits/INT	10	10	300	RPM
M0042	4X0043	Number of cycles of the pump rocking start	- - -	16bits/INT	5	1	10	- - -
D0032	4x10065	Maximum torque on the rod during start	- - -	32bits/Float	0.0	0.0	100.0	%
Line Pressure								
R0020	0x0021	Monitoring of the production line pressure and/or the production line pressure	ON = Enables the monitoring of the LL and L limits	8bits/Bool	ON	OFF	ON	- - -
R0002	0x0003	Return to operation after a very low pressure fault (LL) ends	ON = Enable	8bits/Bool	ON	OFF	ON	- - -
M0031	4x0032	Time to confirm pressure condition LL and L	- - -	16bits/INT	30	1	300	s
M0411	4x0412	Line pressure value	- - -	16bits/INT	RO	0	32767	psi
D0013	4x10027	Production line low pressure limit (L). Triggers possible production line leakage alert.	- - -	32bits/Float	0	0.0	10000.0	psi
D0014	4x10029	Production line very low pressure limit (LL) Signals production line leakage fault	- - -	32bits/Float	0	0.0	10000.0	psi
R0208	0x0209	Command for recognition of production line very low pressure (leakage) alarm	ON = Recognizes alarm	8bits/Bool	- - -	OFF	ON	- - -
R0408	0X0409	Production line low pressure (L) alarm	ON = Alarm	8bits/Bool	RO	OFF	ON	- - -
R0409	0X0410	Production line very low pressure fault (LL)	ON = Fault	8bits/Bool	RO	OFF	ON	- - -
R0021	0x0022	Monitoring of the production line pressure and/or the production line pressure	ON = Enables the monitoring of the HH and H limits	8bits/Bool	ON	OFF	ON	- - -
R0007	0X0008	Return to operation after a very high pressure fault (HH) ends	ON = Enable	8bits/Bool	ON	OFF	ON	- - -
D0009	0X0010	Production line very high pressure limit (HH)	- - -	32bits/Float	1000.0	0.0	10000.0	psi

Quick Reference of Parameters / Communication Table

Parameter	Address	Description	Status	Size	Default	Min.	Max.	Unit
D0026	4X10053	Production line high pressure limit (H)	- - -	32bits/Float	1000.0	0.0	10000.0	psi
M0010	4X0011	Time to confirm the production line high (h) and very high pressure (HH)	- - -	16bits/INT	30	0	320	s
R0416	0x0417	Production line high pressure alarm (H)	ON = Alarm	8bits/Bool	RO	OFF	ON	- - -
R0403	0x0404	Production line very high pressure fault (HH)	ON = Fault	8bits/Bool	RO	OFF	ON	- - -
Motor Torque								
R0014	0x0015	Monitoring of the motor maximum torque	ON = Enables the monitoring of the torque	8bits/Bool	ON	OFF	ON	- - -
M0045	4x0046	Time to wait for the 1st condition of the motor maximum torque	- - -	16bits/INT	60	0	600	s
M0046	4x0047	Time to wait for the 2nd condition of the motor maximum torque	- - -	16bits/INT	180	60	3000	s
D0033	4x10067	Motor reduced speed reference when reaching maximum torque	- - -	32bits/Float	800	0	3600	RPM
R0015	0x0016	Monitoring of the motor maximum torque	ON = Enables the monitoring of the torque	8bits/Bool	ON	OFF	ON	- - -
M0047	4x0048	Time to confirm the motor minimum torque condition	- - -	16bits/INT	120	0	6600	s
D0034	4x10069	Motor minimum torque limit	- - -	32bits/Float	15.0	0.0	100.0	%
R0422	0x0423	Motor maximum torque fault	ON = Fault	8bits/Bool	RO	OFF	ON	- - -
R0423	0x0424	Motor minimum torque fault	ON = Fault	8bits/Bool	RO	OFF	ON	- - -
Rod Torque								
R0018	0x0019	Enables the monitoring of the torque on the rod	ON = Enables the monitoring of the torque on the rod	8bits/Bool	ON	OFF	ON	- - -
D0035	4x10071	Very high torque on the rod limit (HH)	- - -	32bits/Float	45000.0	1.0	100000.0	Nm
D0036	4x10073	High torque on the rod limit (H)	- - -	32bits/Float	43000.0	1.0	100000.0	Nm
D0037	4x10075	Low torque on the rod limit (L)	- - -	32bits/Float	10000.0	0.0	100000.0	Nm
D0038	4x10077	Very low torque on the rod limit (LL)	- - -	32bits/Float	8000.0	0.0	100000.0	Nm
M0038	4x0039	Bypass time Minimum rod torque - LL alarm limit	- - -	16bits/INT	10	0	32000	s
R0424	0x0425	Very high torque on the rod fault (HH)	ON = Fault	8bits/Bool	RO	OFF	ON	- - -
R0425	0x0426	High torque on the rod alarm (H)	ON = Alarm	8bits/Bool	RO	OFF	ON	- - -
R0426	0x0427	Low torque on the rod alarm (L)	ON = Alarm	8bits/Bool	RO	OFF	ON	- - -
R0427	0x0428	Very low torque on the rod fault (LL)	ON = Fault	8bits/Bool	RO	OFF	ON	- - -
D0132	4x10265	Current torque on the rod (Nm) calculated by the ALD11-PCP controller	- - -	32bits/Float	RO	0.0	3.4E+38	Nm
Motor Torque Monitoring								
R0014	0x0015	Monitoring of the maximum motor torque	ON = Enable	8bits/Bool	ON	OFF	ON	- - -
M0039	4x0040	Operating time in torque limitation	- - -	16bits/INT	600	0	30000	s
D0039	4x10079	Nominal motor torque	- - -	32bits/Float	160.8	1.0	100000.0	Nm
D0040	4x10081	Maximum torque limit on the rod	- - -	32bits/Float	50000.0	1.0	100000.0	Nm
Motor Temperature								
R0017	0x0018	Monitoring of the motor temperature	ON = Enable	8bits/Bool	ON	OFF	ON	- - -
D0030	4x10061	Limit for very high motor temperature (HH), phases R, S and T	- - -	32bits/Float	100.0	0	250.0	° C

Parameter	Address	Description	Status	Size	Default	Min.	Max.	Unit
D0031	4x10063	Limit for high motor temperature (H), phases R, S and T	- - -	32bits/Float	90.0	0	250.0	° C
R0428	0x0429	Motor very high temperature fault (HH)	ON = Fault	8bits/Bool	RO	OFF	ON	- - -
R0429	0x0430	Motor high temperature alarm (H)	ON = Alarm	8bits/Bool	RO	OFF	ON	- - -
Analog Downhole Sensor								
R0027	0x0028	Downhole pressure handling	ON = Enables the handling of the downhole pressure alarms HH and LL OFF = Disable	8bits/Bool	ON	OFF	ON	- - -
D0016	4x10033	Maximum limit for downhole pressure	- - -	32bits/Float	10000.0	1	10000.0	psi
D0015	4x10031	Minimum limit for downhole pressure	- - -	32bits/Float	1.0	1	10000.0	psi
M0037	4x0038	Downhole pressure bypass time: HH alarm limit	- - -	16bits/INT	10	0	32000	s
M0412	4x0413	Downhole pressure value	- - -	16bits/INT	RO	0	32767	psi
R0404	0x0405	Minimum downhole pressure fault	ON = Fault	8bits/Bool	RO	OFF	ON	- - -
R0405	0x0406	Maximum downhole pressure alarm	ON = Alarm	8bits/Bool	RO	OFF	ON	- - -
M0417	4x0418	Downhole temperature value	- - -	16bits/INT	RO	0	32767	° C
D0017	4x10035	Maximum limit for downhole temperature	- - -	32bits/Float	250.0	10.0	500.0	° C
R0406	0x0407	Maximum downhole temperature fault	ON = Fault	8bits/Bool	RO	OFF	ON	- - -
Modbus Downhole Sensor								
M0079	4X0080	Type of downhole sensor used in the well	0 = None 5 = Analog sensor 100 = Modbus sensor	16bits/INT	0	0	100	- - -
M0077	4x0078	Downhole device address for Modbus communication	- - -	16bits/INT	127	0	1000	- - -
M0078	4x0079	ALC11 communication port for communication	0 = COM1 1 = COM2 2 = COM3	16bits/INT	1	0	2	- - -
D0052	4x10104	Modbus address for reading on the downhole sensor: Downhole pressure	- - -	32bits/DINT	40001	30001	50000	- - -
D0053	4x10106	Multiplier factor for downhole sensor conversion: Downhole pressure	- - -	32bits/ Float	0.010	0	3.4E+38	bar
D0054	4x10108	Modbus address for reading on the downhole sensor: Downhole temperature	- - -	32bits/DINT	40003	30001	50000	- - -
D0055	4x10110	Multiplier factor for downhole sensor conversion: Downhole temperature	- - -	32bits/ Float	0.010	0	3.4E+38	°C
D0056	4x10112	Modbus address for reading on the downhole sensor: Sensor current	- - -	32bits/DINT	40005	30001	50000	- - -
D0057	4x10114	Multiplier factor for downhole sensor conversion: Sensor current	- - -	32bits/ Float	0.100	0	3.4E+38	A
D0058	4x10116	Modbus address for reading on the downhole sensor: Sensor voltage	- - -	32bits/DINT	40007	30001	50000	- - -
D0059	4x10118	Multiplier factor for downhole sensor conversion: Sensor voltage	- - -	32bits/ Float	0.100	0	3.4E+38	V
D0060	4x10120	Modbus address for reading on the downhole sensor: Vz vibration	- - -	32bits/DINT	40009	30001	50000	- - -
D0061	4x10122	Multiplier factor for downhole sensor conversion: Vz vibration	- - -	32bits/ Float	0.001	0	3.4E+38	g
D0062	4x10124	Modbus address for reading on the downhole sensor: Vx vibration	- - -	32bits/DINT	40011	30001	50000	- - -

Parameter	Address	Description	Status	Size	Default	Min.	Max.	Unit
D0063	4x10126	Multiplier factor for downhole sensor conversion: Vx vibration	- - -	32bits/ Float	0.001	0	3.4E+38	g
D0064	4x10128	Downhole pressure low limit	- - -	32bits/Float	5.0	1.0	10000.0	psi/bar
D0066	4x10132	Downhole temperature high limit	- - -	32bits/Float	80.0	10.0	500.0	°C
D0113	4x10226	Downhole pressure value	- - -	32bits/DINT	RO	- - -	- - -	[EU]
D0114	4x10228	Downhole temperature value	- - -	32bits/DINT	RO	- - -	- - -	[EU]
D0115	4x10230	Sensor current value	- - -	32bits/DINT	RO	- - -	- - -	[EU]
D0116	4x10232	Sensor voltage value	- - -	32bits/DINT	RO	- - -	- - -	[EU]
D0117	4x10234	Vz vibration value	- - -	32bits/DINT	RO	- - -	- - -	[EU]
D0118	4x10236	Vx vibration value	- - -	32bits/DINT	RO	- - -	- - -	[EU]
D0015	4x10031	Downhole pressure minimum limit	- - -	32bits/Float	1.0	1	10000.0	psi
D0017	4x10035	Downhole temperature maximum limit	- - -	32bits/Float	250.0	10.0	500.0	° C
M0084..85	4x0085..86	Downhole sensor engineering unit: Downhole pressure	- - -	16bits/INT	bar	- - -	- - -	- - -
M0086..87	4x0087..88	Downhole sensor engineering unit: Temperatura de fundo	- - -	16bits/INT	°C	- - -	- - -	- - -
M0088..89	4x0089..90	Downhole sensor engineering unit: Corrente do sensor	- - -	16bits/INT	mA	- - -	- - -	- - -
M0090..91	4x0091..92	Downhole sensor engineering unit: Tensão do sensor	- - -	16bits/INT	V	- - -	- - -	- - -
M0092..93	4x0093..94	Downhole sensor engineering unit: Vibração Vz	- - -	16bits/INT	g	- - -	- - -	- - -
M0094..95	4x0095..96	Downhole sensor engineering unit: Vibração Vx	- - -	16bits/INT	g	- - -	- - -	- - -
M0072	4x0073	Time to confirm LL and L limit downhole pressure	- - -	16bits/INT	30	0	120	s
M0073	4x0074	Time to confirm HH and H limit downhole temperature	- - -	16bits/INT	30	0	120	s
R0094	0x0095	Downhole pressure minimum limit alarm	ON = Fault	8bits/Bool	RO	OFF	ON	- - -
R0096	0x0097	Downhole temperature maximum limit alarm	ON = Fault	8bits/Bool	RO	OFF	ON	- - -
R0142	4x0143	Downhole pressure L limit alarm	ON = Alarm	8bits/Bool	RO	OFF	ON	- - -
R0143	4x0144	Downhole temperature H limit alarm	ON = Alarm	8bits/Bool	RO	OFF	ON	- - -
R0144	4x0145	Modbus communication fault with downhole sensor	ON = Fault	8bits/Bool	RO	OFF	ON	- - -
Operation Time								
R0001	0x0002	Duty operation	ON = Operation with duty time OFF = 24-hour continuous operation	8bits/Bool	OFF	OFF	ON	- - -
M0004	4x0005	Hours of the time set to start the duty operation interval	- - -	16bits/INT	0	0	23	h
M0005	4x0006	Minutes of the time set to start the duty operation interval	- - -	16bits/INT	0	0	59	min
M0006	4x0007	Hours of the time set to end the duty operation interval	- - -	16bits/INT	0	0	23	h
M0007	4x0008	Minutes of the time set to end the duty operation interval	- - -	16bits/INT	0	0	59	min
R0109	0x0110	When operation in duty time is enabled, it is possible to identify if the system is operating within or out of the duty time	ON = System operating out of the duty time OFF = System operating within the duty time	8bits/Bool	RO	OFF	ON	- - -
Locking Time for Pump Automatic Return								
R0006	0x0007	Handling of the locking time for the pump automatic return	ON = Disable OFF = Enable	8bits/Bool	ON	OFF	ON	- - -

Quick Reference of Parameters / Communication Table

Parameter	Address	Description	Status	Size	Default	Min.	Max.	Unit
M0000	4x0001	Hours of the time set to start the locking interval for return	- - -	16bits/INT	0	0	23	h
M0001	4x0002	Minutes of the time set to start the locking interval for return	- - -	16bits/INT	0	0	59	min
M0002	4x0003	Hours of the time set to end the locking interval for return	- - -	16bits/INT	0	0	23	h
M0003	4x0004	Minutes of the time set to end the locking interval for return	- - -	16bits/INT	0	0	59	min
R0110	0x0111	When the operation with locking time is enabled, it is possible to identify if the system is operating within or out of the locking time	ON = System operating within the locking time OFF = System operating out of the locking time	8bits/Bool	RO	OFF	ON	- - -
Automatic Restart								
M0018	4x0019	Time for automatic pump restart after failure	- - -	16bits/INT	30	0	120	min
M0019	4x0020	Number of attempts for automatic restart within a time interval	- - -	16bits/INT	3	0	5	- - -
M0032	4x0033	Time interval to allow amount of automatic restart	- - -	16bits/INT	12	1	24	h
M0033	4x0034	Minimum speed operation time for reset automatic restart attempts	- - -	16bits/INT	5	0	600	min
M0106	4x0107	NVR: RST: Fault counter within the time range for automatic restart	- - -	16bits/INT	RO	0	5	- - -
Well Identification								
M0172 – M0175	4x0173 – 176	Well identification name. No delimiter required for the end of the string [4M = 8 characters]	- - -	16bits/INT	- - -	0	32767	- - -
Enable Local Mode								
R0026	0x0027	Local mode	ON = Enable local mode OFF= Disable local mode	8bits/Bool	ON	OFF	ON	- - -
Undervoltage Automatic Restart								
R0028	0x0029	Undervoltage Automatic Restart	ON = Enables restart after undervoltage	8bits/Bool	OFF	OFF	ON	- - -
Well Identification Name								
M0080 – M0083	4x0081-0084	Well identification name. No delimiter required for the end of the string [4M = 8 characters]	- - -	16bits/INT	0	0	32767	- - -
Save Configuration to Flash Command								
R0204	0x0205	Command to process and save the well configuration base in the flash	- - -	8bits/Bool	0	0	1	- - -
Well Global Settings								
D0005	4x10011	Pump pulley diameter	- - -	32bits/Float	240.0	50.0	1000.0	mm
D0004	4x10009	Motor pulley diameter	- - -	32bits/Float	60.0	20.0	500.0	mm
D0024	4x10049	Head reduction	- - -	32bits/Float	4	1	50	- - -
M0017	4x0018	Well base potential	- - -	16bits/INT	10	1	1000	m³/d
D0012	4x10025	Motor rated current	- - -	32bits/Float	75	0	10000	A
D0025	4x10051	Motor rated speed	- - -	32bits/Float	1800	10	20000	RPM
R0214	0x0215	Command to initialize the well settings base with default values	- - -	8bits/Bool	OFF	OFF	ON	- - -
R0206	0x0207	Command to process new update of the system setting parameters	ON = Update	8bits/Bool	OFF	OFF	ON	- - -
Field Instrumentation Settings								
R0004	0x0005	Downhole sensor is present.	ON = Downhole transmitter is present	8bits/Bool	OFF	OFF	ON	- - -
D0002	4x10005	Maximum scale of the downhole pressure transmitter	- - -	32bits/Float	1000.0	1.0	10000.0	psi

Quick Reference of Parameters / Communication Table

Parameter	Address	Description	Status	Size	Default	Min.	Max.	Unit
D0003	4x10007	Maximum scale of the downhole temperature transmitter	- - -	32bits/Float	250.0	10.0	500.0	° C
D0001	4x10003	Maximum scale of the production line pressure transmitter	- - -	32bits/Float	1000.0	1.0	10000.0	psi
General Controller Settings								
M0196	4x0197	CMD: Return code of command execution	- - -	16bits/INT	0	-32768	32767	Bit 0..15
M0197	4x0198	CMD: Internal for ALC11	- - -	16bits/INT	0	-32768	32767	Bit 0..15
Controller RTC Settings								
M0197	4x0198	CMD: Internal for ALC11	200 – Read the RTC of the ALC11 controller 201 – Program the RTC of the ALC11 controller	16bits/INT	0	-32768	32767	Bit 0..15
M0196	4x0197	CMD: Return code of command execution	0 = SUCCESS, nonzero indicates error code	16bits/INT	0	-32768	32767	Bit 0..15
M0188	4x0189	Day	- - -	16bits/INT	- - -	1	31	- - -
M0189	4x0190	Month	- - -	16bits/INT	- - -	1	12	- - -
M0190	4x0191	Year	- - -	16bits/INT	- - -	1980	2047	- - -
M0191	4x0192	Hour	- - -	16bits/INT	- - -	0	23	- -
M0192	4x0193	Minutes	- - -	16bits/INT	- - -	0	59	- - -
M0193	4x0194	Seconds	- - -	16bits/INT	- - -	0	59	- - -
M0194	4x0195	Day of Week	(0..6, 0=Sunday, 1=Monday, etc.)	16bits/INT	- - -	0	6	- - -
Controller IP Settings								
M0197	4x0198	CMD: Internal for ALC11	210 = Read the controller IP address 211 = Program IP address of the controller	16bits/INT	0	-32768	32767	Bit 0..15
M0196	4x0197	CMD: Return code of command execution	0 = SUCCESS, nonzero indicates error code	16bits/INT	0	-32768	32767	Bit 0..15
M0191	4x0192	IP4 address	- - -	16bits/INT	200	0	259	- -
M0192	4x0193	IP3 address	- - -	16bits/INT	0	0	259	- - -
M0193	4x0194	IP2 address	- - -	16bits/INT	168	0	259	- - -
M0194	4x0195	IP1 address	- - -	16bits/INT	192	0	259	- - -
System Status								
R0140	0x0141	Manual / Automatic selection	OFF = Manual Mode ON = Automatic Mode	8bits/Bool	RO	OFF	ON	- - -
R0431	0x0432	Emergency Status	ON = Emergency actuated	8bits/Bool	RO	OFF	ON	- - -
R0105	0x0106	ALC Status	ON = Active alarm in the system	8bits/Bool	RO	OFF	ON	- - -
M0141	4x0142	ALC Status Word	- - -	16bits/INT	0	-32768	32767	Bit 0..15
M0421	4x0422	Current rotation value on the rod	- - -	16bits/INT	RO	0	32767	RPM
M0142	4x0143	STS Operating mode for CFW11 HMI	1 = Local 3 = Manual remote manual 4 = Automatic remote	16bits/INT	RO	1	4	- - -
M0440	4x0441	Day	- - -	16bits/INT	RO	1	31	- - -
M0442	4x0443	Year	- - -	16bits/INT	RO	1980	2047	- - -
M0443	4x0444	Hour	- - -	16bits/INT	RO	0	23	- -
M0444	4x0445	Minutes	- - -	16bits/INT	RO	0	59	- - -
M0445	4x0446	Seconds	- - -	16bits/INT	RO	0	59	- - -
M0446	4x0447	Day of Week	(0..6, 0=Sunday, 1=Monday, etc.)	16bits/INT	RO	0	6	- - -

Parameter	Address	Description	Status	Size	Default	Min.	Max.	Unit
D0085	4x10171	Pump ON Time	- - -	32bits/Float	RO	0	87000	h
D0086	4x10173	Pump OFF Time	- - -	32bits/Float	RO	0	87000	h
R0084	0x0085	Failure to access CFW11 via DPRAM	ON = Fault	8bits/Bool	RO	OFF	ON	- - -
R0086	0x0087	Invalid controller date and time flag	ON = Invalid date and time	8bits/Bool	RO	OFF	ON	- - -
R0388	0x0389	CFW11 Alarm	ON = Inverter with alarm	8bits/Bool	RO	OFF	ON	- - -
R0389	0x0390	CFW11 Undervoltage	ON = Inverter with undervoltage	8bits/Bool	RO	OFF	ON	- - -
R0390	0x0391	CFW11 Mode	ON = Inverter in REMOTO OFF = Inverter in LOCAL	8bits/Bool	RO	OFF	ON	- - -
R0391	0x0392	CFW11 Fault	ON = Inverter with fault OFF = Inverter without fault	8bits/Bool	RO	OFF	ON	- - -
R0392	0x0393	Motor Status	ON = Motor running OFF = Motor stopped	8bits/Bool	RO	OFF	ON	- - -
R0393	0x0394	CFW11 Enabled	ON = Inverter enabled OFF = Inverter disabled	8bits/Bool	RO	OFF	ON	- - -
R0394	0x0395	CFW11 Direction of rotation	ON = Forward OFF = Reverse	8bits/Bool	RO	OFF	ON	- - -
System I/O Status								
M0374	4x0375	Bit-mapped controller I/O map	Bit 0 ALC11 = Digital output O0 Bit 1 ALC11 = Digital output O1 Bit 2 ALC11 = Digital output O2 Bit 3 ALC11 = Digital output O3 Bit 4 – 7 = Reserve Bit 8 ALD11 = Digital output O8 Bit 9 ALD11 = Digital output O9 Bit 10 ALD11 = Digital output O10 Bit 11 – 15 = Reserve	16bits/INT	0	-32768	32767	Bit 0..15
M0375	4x0376	Bit-mapped controller I/O map	Bit 0 ALC11 = Digital input I5 Bit 1 – 4 = Reserve Bit 5 ALC11 = Digital input I4 Bit 6 = Reserve Bit 7 ALD11 = Digital input I8 Bit 8 = Reserve Bit 9 ALC11 = Digital input I2 (inverted state) Bit 10 ALD11 = Digital input I10 Bit 11 ALD11 = Digital input I11 (inverted state) Bit 12 ALC11 = Digital input I2 (inverted state) Bit 13 ALC11 = Digital input I3 (inverted state) Bit 14 – 15 = Reserve	16bits/INT	0	-32768	32767	Bit 0..15

Parameter	Address	Description	Status	Size	Default	Min.	Max.	Unit
M0376	4x0377	Bit-mapped controller I/O map	Bit 0 – 7 = Reserve Bit 8 ALC11 = Digital input I0 Bit 9 ALC11 = Digital input I1 Bit 10 ALD11 = Digital input I9 Bit 11 ALD11 = Digital input I13 (inverted state) Bit 12 – 15 = Reserve	16bits/INT	0	-32768	32767	Bit 0..15
M0386	4x0387	ALC11 - Analog input I0	- - -	16bits/INT	RO	-1	4095	- - -
M0398	4x0399	ALC11 - Analog input I1	- - -	16bits/INT	RO	-1	4095	- - -
M0399	4x0400	ALC11 - Analog input I2	- - -	16bits/INT	RO	-1	4095	- - -
M0391	4x0392	ALC11 - Analog input I3	- - -	16bits/INT	RO	-1	4095	- - -
M0392	4x0393	ALC11 - Analog input I4	- - -	16bits/INT	RO	-1	4095	- - -
M0393	4x0394	ALC11 - Analog input I5	- - -	16bits/INT	RO	-1	4095	- - -
M0385	4x0386	ALC11 - Analog input I6, load cell in 12 bits	- - -	16bits/INT	RO	-4095	4095	- - -
M0387	4x0388	ALD11 - Analog input I7	- - -	16bits/INT	RO	-1	4095	- - -
M0397	4x0398	ALD11 - Analog input I8	- - -	16bits/INT	RO	-1	4095	- - -
M0377	4x0378	ALD11 – Analog output O0	- - -	16bits/INT	RO	0	4095	- - -
M0378	4x0379	ALD11 – Analog output O1	- - -	16bits/INT	RO	0	4095	- - -
Alarm Status								
R0087	0x0088	Pump rocking start failure alarm	- - -	8bits/Bool	RO	OFF	ON	- - -
R0088	0x0089	Maximum motor torque limit alarm	- - -	8bits/Bool	RO	OFF	ON	- - -
R0089	0x0090	Minimum motor torque limit alarm	- - -	8bits/Bool	RO	OFF	ON	- - -
R0090	0x0091	Motor current lower limit alarm (LL)	- - -	8bits/Bool	RO	OFF	ON	- - -
R0091	0x0092	Motor current higher limit alarm (HH)	- - -	8bits/Bool	RO	OFF	ON	- - -
R0092	0x0093	Frequency inverter failure	- - -	8bits/Bool	RO	OFF	ON	- - -
R0093	0x0094	Line pressure higher limit alarm (HH)	- - -	8bits/Bool	RO	OFF	ON	- - -
R0094	0x0095	Downhole pressure lower limit alarm	- - -	8bits/Bool	RO	OFF	ON	- - -
R0095	0x0096	Downhole pressure higher limit alarm	- - -	8bits/Bool	RO	OFF	ON	- - -
R0096	0x0097	Downhole temperature higher limit alarm	- - -	8bits/Bool	RO	OFF	ON	- - -
R0097	0x0098	Invalid configuration parameters	- - -	8bits/Bool	RO	OFF	ON	- - -
R0098	0x0099	Possible line leakage warning	- - -	8bits/Bool	RO	OFF	ON	- - -
R0099	0x0100	Line leakage alarm	- - -	8bits/Bool	RO	OFF	ON	- - -
R0101	0x0102	Maximum limit of rod rotation alarm	- - -	8bits/Bool	RO	OFF	ON	- - -
R0102	0x0103	Minimum limit of rod rotation alarm	- - -	8bits/Bool	RO	OFF	ON	- - -
R0103	0x0104	Low line pressure warning, possible line leakage	- - -	8bits/Bool	RO	OFF	ON	- - -
R0106	0x0107	Status in line “LEAKAGE” condition	- - -	8bits/Bool	RO	OFF	ON	- - -
R0331	0x0332	Maximum line pressure limit failure (PSHH)	- - -	8bits/Bool	RO	OFF	ON	- - -

Parameter	Address	Description	Status	Size	Default	Min.	Max.	Unit
M0370	4x0371	Bit-mapped status flags for supervisory	- - -	16bits/INT	0	-32768	32767	Bit 0..15
M0406	4x0407	Bit-mapped controller I/O map	Bit 0..1 = (Not used in ALC11) Bit 2 = Frequency converter fault or frequency inverter access fault Bit 3 = Production line very high pressure (HH) Bit 4 = Minimum downhole pressure Bit 5 = Maximum downhole pressure Bit 6 = Maximum downhole temperature Bit 7 = Invalid settings base Bit 8 = Possible leakage in the production line (L) Bit 9 = Effective leakage in the production line (LL) Bit 10 = Pump motor ON/OFF status Bit 11 = (Not used in ALC11) Bit 12 = Rod maximum speed Bit 13 = Rod minimum speed Bit 14 = RTC access error or invalid date and time on the controller Bit 15 = (Not used in ALC11)	16bits/INT	0	-32768	32767	Bit 0..15
M0407	4x0408	Bit-mapped controller I/O map	Bit 0 = Production line high pressure (H) Bit 1..2 = (Not used in ALC11) Bit 3 = Motor Overload Fault or Alarm Bit 4 = EXTERNAL FAULT Bit 5 = EXTERNAL ALARM Bit 6 = Motor maximum torque Bit 7 = Motor minimum torque Bit 8 = Torque on the Rod Maximum HH limit Bit 9 = Torque on the Rod Maximum H limit Bit 10 = Torque on the Rod Minimum L limit Bit 11 = Torque on the Rod Minimum LL limit Bit 12 = Motor winding temperature maximum HH limit Bit 13 = Motor winding temperature maximum H limit Bit 14 = Rocking start fault Bit 15 = Emergency actuated	16bits/INT	0	-32768	32767	Bit 0..15

Parameter	Address	Description	Status	Size	Default	Min.	Max.	Unit
M0409	4x0410	Bit-mapped controller I/O map	Bit 0 = Leakage alarm (I4 ALC) Bit 1 = Leakage condition fault (DI3 CFW11 = Leakage Sensor) Bit 2 = Power supply fault (DI5 = generated by SRW) Bit 3 = Controlled stop fault, Bit 7 of P1044 = Reversal fault Bit 4 = Hydraulic brake test fault, Bit 8 of P1044 = hydraulic brake fault Bit 5 = Low or no battery in the ALC11 CPU alarm Bit 6..15 = (Not used in ALC11)	16bits/INT	0	-32768	32767	Bit 0..15
R0003	0x0004	Enables leakage monitoring	ON = Enables leakage monitoring (digital signal)	8bits/Bool	ON	OFF	ON	- - -
Data History								
M0023	4x0024	Time interval for storing process data in the SDCARD	The value 0 (zero) disables the process data storage	16bits/INT	30	0	1440	min
M0022	4x0023	Interval for card history	- - -	16bits/INT	0	0	24	hours
R0100	0x0101	History in circular buffer of the ALC11	ON = Disables the data log	8bits/Bool	OFF	OFF	ON	- - -
M0036	4x0037	History data record type	History data record type code = 0: 1. Motor current [A] 2. Line pressure [psi] 3. Downhole pressure [psi] 4. Rod speed [RPM]] History data record type code = 1: 1. Motor current [A] 2. Line pressure [psi] 3. Motor torque [%] 4. Rod speed [RPM] History data record type code = 2: 1. Motor current [A] 2. Line pressure [psi] 3. Motor speed [RPM] 4. Rod speed [RPM]	16bits/INT	0	0	2	- - -
M0030	4x0031	History data record interval	- - -	16bits/INT	600	1	32000	s
R0205	0x0206	Command to reset the history data buffer	ON = Reset buffer	16bits/INT	OFF	OFF	ON	- - -
M0500 ... M1299	4x0501 ... 4x1300	History data buffer (800 M-type memories)	- - -	16bits/INT	- - -	-32768	32767	- - -
R0209	0x0210	CMD: Reset storage counter	- - -	8bits/Bool	- - -	0	1	- - -
M1304	4x1305	Storage buffer M current index. Value scale ranges from 500 to 1300, with values at 4-in-4 intervals, type 500, 504, 508, etc., since each data record contains 4 variables M	- - -	16bits/INT	- - -	500	1300	- - -
M1309	4x1310	Acquisitions counter since last buffer reading	- - -	16bits/INT	- - -	0	200	- - -

Parameter	Address	Description	Status	Size	Default	Min.	Max.	Unit
M1305	4x1306	Date and time of the last data record stored in the history data buffer	Bit 0..7 = seconds (0..59) Bit 8..15 = day of the week (1..7, 1 = Sunday, 2 = Monday, etc.)	16bits/INT	- - -	-32768	32767	Bits 0..15
M1306	4x1307	Date and time of the last data record stored in the history data buffer	Bit 0..7 = minutes (0..59) Bit 8..15 = hours (0..23)	16bits/INT	- - -	-32768	32767	Bits 0..15
M1307	4x1308	Date and time of the last data record stored in the history data buffer	Bit 0..5 = day of the month (1..31) Bit 6..9 = month (1..12) Bit 10..15 = year, 1990 offset must be added	16bits/INT	- - -	-32768	32767	Bits 0..15
M2644	4x2645	LOG EVE: Time stamp of the event occurrence	- - -	16bits/INT	0	0	32767	- - -
M2645	4x2646	LOG EVE: Time stamp of the event occurrence	- - -	16bits/INT	0	0	32767	- - -
M2646	4x2647	LOG EVE: Event type (event, alarm, fault)	- - -	16bits/INT	0	0	32767	- - -
M2647	4x2648	LOG EVE: Event code	- - -	16bits/INT	0	0	32767	- - -
CFW11 Parameters								
P0000	4x8000	Access to Parameters	- - -	16bits/INT	0	0	9999	- - -
P0001	4x8001	Speed Reference	- - -	16bits/INT	RO	0	18000	RPM
P0002	4x8002	Motor Speed	- - -	16bits/INT	RO	0	18000	RPM
P0003	4x8003	Motor Current	- - -	16bits/INT	RO	0	4500.0	A
P0004	4x8004	DC-Link Voltage	- - -	16bits/INT	RO	0	2000	V
P0005	4x8005	Motor Frequency	- - -	16bits/INT	RO	0	1020.0	HZ
P0006	4x8006	Status Drive	0 = Ready 1 = Run 2 = Undervoltage 3 = Fault 4 = Self-Tuning 5 = Settings 6 = DC Braking 7 = STO	16bits/INT	RO	0	28	- - -
P0007	4x8007	Motor Voltage	- - -	16bits/INT	RO	0	2000	V
P0009	4x8009	Motor Torque	- - -	16bits/INT	RO	-1000.0	1000.0	%
P0010	4x8010	Output Power	- - -	16bits/INT	RO	0	6553.5	KW
P0011	4x8011	Output cos ϕ	- - -	16bits/INT	RO	0	1.00	- - -
P0012	4x8012	DI8 to DI1 Status	Bit 0 = DI1 Bit 1 = DI2 Bit 2 = DI3 Bit 3 = DI4 Bit 4 = DI5 Bit 5 = DI6 Bit 6 = DI7 Bit 7 = DI8	16bits/INT	RO	--	--	- - -
P0013	4x8013	DO5 to DO1 Status	Bit 0 = DO1 Bit 1 = DO2 Bit 2 = DO3 Bit 3 = DO4 Bit 4 = DO5	16bits/INT	RO	--	--	- - -
P0014	4x8014	AO1 Value	- - -	16bits/INT	RO	0	100.00	%
P0015	4x8015	AO2 Value	- - -	16bits/INT	RO	0	100.00	%
P0016	4x8016	AO3 Value	- - -	16bits/INT	RO	-100.00	100.00	%
P0017	4x8017	AO4 Value	- - -	16bits/INT	RO	-100.00	100.00	%

Quick Reference of Parameters / Communication Table

Parameter	Address	Description	Status	Size	Default	Min.	Max.	Unit
P0018	4x8018	AI1 Value	- - -	16bits/INT	RO	-100.00	100.00	%
P0019	4x8019	AI2 Value	- - -	16bits/INT	RO	-100.00	100.00	%
P0020	4x8020	AI3 Value	- - -	16bits/INT	RO	-100.00	100.00	%
P0021	4x8021	AI4 Value	- - -	16bits/INT	RO	-100.00	100.00	%
P0023	4x8023	Software Version	45.20	16bits/INT	RO	0	655.35	
P0025	4x8025	DI16 to DI9 Status	Bit 0 = DI9 Bit 1 = DI10 Bit 2 = DI11 Bit 3 = DI12 Bit 4 = DI13 Bit 5 = DI14 Bit 6 = DI15 Bit 7 = DI16	16bits/INT	RO	–	–	- - -
P0026	4x8026	DO13 to DO6 Status	Bit 0 = DO6 Bit 1 = DO7 Bit 2 = DO8 Bit 3 = DO9 Bit 4 = DO10 Bit 5 = DO11 Bit 6 = DO12 Bit 7 = DO13	16bits/INT	RO	–	–	- - -
P0027	4x8027	Config. Accessories 1	- - -	- -	RO	0000h	FFFFh	- - -
P0028	4x8028	Config. Accessories 2	- - -	- -	RO	0000h	FFFFh	- - -
P0029	4x8029	Config. Power HW	Bit 0 to 5 = Rated Current Bit 6 and 7 = Rated Voltage Bit 8 = EMC Filter Bit 9 = Safety relay Bit 10 = (0) 24 V/(1) DC-Link Bit 11 = special DC Hw Bit 12 = IGBT Braking Bit 13 = Special Bits 14 and 15 = Reserved	16bits/INT	RO	–	–	- - -
P0030	4x8030	IGBTs Temperature U	- - -	16bits/INT	RO	-20.0	-150.0	ºC
P0031	4x8031	IGBTs Temperature V	- - -	16bits/INT	RO	-20.0	-150.0	ºC
P0032	4x8032	IGBTs Temperature W	- - -	16bits/INT	RO	-20.0	-150.0	ºC
P0033	4x8033	Temperature Rectifier	- - -	16bits/INT	RO	-20.0	-150.0	ºC
P0034	4x8034	Temperature Internal Air	- - -	16bits/INT	RO	-20.0	-150.0	ºC
P0035	4x8035	Air temperature control	- - -	16bits/INT	RO	-20.0	-150.0	ºC
P0036	4x8036	Fan Speed	- - -	16bits/INT	RO	0	15000	RPM
P0037	4x8037	Motor Overload	- - -	16bits/INT	RO	0	100.00	%
P0038	4x8038	Encoder Speed	- - -	16bits/INT	RO	0	65535	RPM
P0039	4x8039	Encoder Pulse Counter	- - -	16bits/INT	RO	0	40000	RPM
P0040	4x8040	PID Process Variable	- - -	16bits/INT	RO	0	100.00	%
P0041	4x8041	PID Setpoint Value	- - -	16bits/INT	RO	0	100.00	%
P0042	4x8042	Hours Energized	- - -	16bits/INT	RO	0	65535	h
P0043	4x8043	Hours Enabled	- - -	16bits/INT	RO	0	65535	h
P0044	4x8044	kWh Counter	- - -	16bits/INT	RO	0	65535	kWh
P0045	4x8045	Hours Fan On	- - -	16bits/INT	RO	0	65535	h
P0048	4x8048	Present Alarm	- - -	16bits/INT	RO	0	999	- - -
P0049	4x8049	Present Fault	- - -	16bits/INT	RO	0	999	- - -
P0050	4x8050	Last Fault	- - -	16bits/INT	RO	0	999	- - -
P0051	4x8051	Last Fault Day/Month	- - -	16bits/INT	RO	00/00	31/12	- - -
P0052	4x8052	Last Fault Year	- - -	16bits/INT	RO	00	99	- - -

Parameter	Address	Description	Status	Size	Default	Min.	Max.	Unit
P0053	4x8053	Last Fault Time	- - -	16bits/INT	RO	00:00	23:59	- - -
P0054	4x8054	Second Fault	- - -	16bits/INT	RO	0	999	- - -
P0055	4x8055	Second Fault Day/Month	- - -	16bits/INT	RO	00/00	31/12	- - -
P0056	4x8056	Second Fault Year	- - -	16bits/INT	RO	00	99	- - -
P0057	4x8057	Second Fault Time	- - -	16bits/INT	RO	00:00	23:59	- - -
P0058	4x8058	Third Fault	- - -	16bits/INT	RO	0	999	- - -
P0059	4x8059	Third Fault Day/Month	- - -	16bits/INT	RO	00/00	31/12	- - -
P0060	4x8060	Third Fault Year	- - -	16bits/INT	RO	00	99	- - -
P0061	4x8061	Third Fault Time	- - -	16bits/INT	RO	00:00	23:59	- - -
P0062	4x8062	Fourth Fault	- - -	16bits/INT	RO	0	999	- - -
P0063	4x8063	Fourth Fault Day/Month	- - -	16bits/INT	RO	00/00	31/12	- - -
P0064	4x8064	Fourth Fault Year	- - -	16bits/INT	RO	00	99	- - -
P0065	4x8065	Fourth Fault Time	- - -	16bits/INT	RO	00:00	23:59	- - -
P0066	4x8066	Fifth Fault	- - -	16bits/INT	RO	0	999	- - -
P0067	4x8067	Fifth Fault Day/Month	- - -	16bits/INT	RO	00/00	31/12	- - -
P0068	4x8068	Fifth Fault Year	- - -	16bits/INT	RO	00	99	- - -
P0069	4x8069	Fifth Fault Time	- - -	16bits/INT	RO	00:00	23:59	- - -
P0070	4x8070	Sixth Fault	- - -	16bits/INT	RO	0	999	- - -
P0071	4x8071	Sixth Fault Day/Month	- - -	16bits/INT	RO	00/00	31/12	- - -
P0072	4x8072	Sixth Fault Year	- - -	16bits/INT	RO	00	99	- - -
P0073	4x8073	Sixth Fault Time	- - -	16bits/INT	RO	00:00	23:59	- - -
P0074	4x8074	Seventh Fault	- - -	16bits/INT	RO	0	999	- - -
P0075	4x8075	Seventh Fault Day/Month	- - -	16bits/INT	RO	00/00	31/12	- - -
P0076	4x8076	Seventh Fault Year	- - -	16bits/INT	RO	00	99	- - -
P0077	4x8077	Seventh Fault Time	- - -	16bits/INT	RO	00:00	23:59	- - -
P0078	4x8078	Eighth Fault	- - -	16bits/INT	RO	0	999	- - -
P0079	4x8079	Eighth Fault Day/Month	- - -	16bits/INT	RO	00/00	31/12	- - -
P0800	4x8080	Eighth Fault Year	- - -	16bits/INT	RO	00	99	- - -
P0081	4x8081	Eighth Fault Time	- - -	16bits/INT	RO	00:00	23:59	- - -
P0082	4x8082	Ninth Fault	- - -	16bits/INT	RO	0	999	- - -
P0083	4x8083	Ninth Fault Day/Month	- - -	16bits/INT	RO	00/00	31/12	- - -
P0084	4x8084	Ninth Fault Year	- - -	16bits/INT	RO	00	99	- - -
P0085	4x8085	Ninth Fault Time	- - -	16bits/INT	RO	00:00	23:59	- - -
P0086	4x8086	Tenth Fault	- - -	16bits/INT	RO	0	999	- - -
P0087	4x8087	Tenth Fault Day/Month	- - -	16bits/INT	RO	00/00	31/12	- - -
P0088	4x8088	Tenth Fault Year	- - -	16bits/INT	RO	00	99	- - -
P0089	4x8089	Tenth Fault Time	- - -	16bits/INT	RO	00:00	23:59	- - -
P0090	4x8090	Last Fault Current	- - -	16bits/INT	RO	0	4000.0	A
P0091	4x8091	Last Fault DC Link Voltage	- - -	16bits/INT	RO	0	2000	V
P0092	4x8092	Last Fault Speed	- - -	16bits/INT	RO	0	18000	RPM
P0093	4x8093	Last Fault Reference	- - -	16bits/INT	RO	0	18000	RPM
P0094	4x8094	Last Fault Frequency	- - -	16bits/INT	RO	0	1020.0	Hz
P0095	4x8095	Last Fault Motor Voltage	- - -	16bits/INT	RO	0	2000	V

Parameter	Address	Description	Status	Size	Default	Min.	Max.	Unit
P0096	4x8096	Last Fault DIx Status	Bit 0 = DI1 Bit 1 = DI2 Bit 2 = DI3 Bit 3 = DI4 Bit 4 = DI5 Bit 5 = DI6 Bit 6 = DI7 Bit 7 = DI8	16bits/INT	RO	--	--	- - -
P0097	4x8097	Last Fault DOx Status	Bit 0 = DO1 Bit 1 = DO2 Bit 2 = DO3 Bit 3 = DO4 Bit 4 = DO5	16bits/INT	RO	--	--	- - -
P0100	4x8100	Acceleration Time	- - -	16bits/INT	20.0	0	999.0	s
P0101	4x8101	Deceleration Time	- - -	16bits/INT	20.0	0	999.0	s
P0102	4x8102	2nd Ramp Acceleration Time	- - -	16bits/INT	20.0	0	999.0	s
P0103	4x8103	2nd Ramp Deceleration Time	- - -	16bits/INT	20.0	0	999.0	s
P0104	4x8104	S Ramp	0 = Inactive 1 = 50 % 2 = 100 %	16bits/INT	0	--	--	- - -
P0105	4x8105	1st/2nd Ramp Selection	0 = 1st Ramp 1 = 2nd Ramp 2 = DIx 3 = Serial/USB 4 = Anybus-CC 5 = CANop/DNet/DP 6 = Reserved 7 = ALC11	16bits/INT	2	--	--	- - -
P0120	4x8120	Speed Reference Backup	0 = Inactive 1 = Active	16bits/INT	1	--	--	- - -
P0121	4x8121	Reference via HMI	- - -	16bits/INT	90	0	18000	RPM
P0122	4x8122	JOG/JOG+ Reference	- - -	16bits/INT	150	0	18000	RPM
P0123	4x8123	JOG- Reference	- - -	16bits/INT	150	0	18000	RPM
P0124	4x8124	Multispeed Reference 1	- - -	16bits/INT	90	0	18000	RPM
P0125	4x8125	Multispeed Reference 2	- - -	16bits/INT	300	0	18000	RPM
P0126	4x8126	Multispeed Reference 3	- - -	16bits/INT	600	0	18000	RPM
P0127	4x8127	Multispeed Reference 4	- - -	16bits/INT	900	0	18000	RPM
P0128	4x8128	Multispeed Reference 5	- - -	16bits/INT	1200	0	18000	RPM
P0129	4x8129	Multispeed Reference 6	- - -	16bits/INT	1500	0	18000	RPM
P0130	4x8130	Multispeed Reference 7	- - -	16bits/INT	1800	0	18000	RPM
P0131	4x8131	Multispeed Reference 8	- - -	16bits/INT	1650	0	18000	RPM
P0132	4x8132	Maximum Overspeed Level	- - -	16bits/INT	10	0	100	%
P0133	4x8133	Minimum Speed	- - -	16bits/INT	90	0	18000	RPM
P0134	4x8134	Maximum Speed	- - -	16bits/INT	1800	0	18000	RPM
P0135	4x8135	Maximum Output Current	- - -	16bits/INT	1,5 x Inom-ND	0	3420.0	A
P0136	4x8136	Manual Torque Boost	- - -	16bits/INT	--	0	9	- - -
P0137	4x8137	Automatic Torque Boost	- - -	16bits/INT	0,00	0	1.00	- - -
P0138	4x8138	Slip compensation	- - -	16bits/INT	0,0	-10.0	10.0	%
P0139	4x8139	Output Current Filter	- - -	16bits/INT	0,2	0	16.0	s
P0140	4x8140	Adaptation Time	- - -	16bits/INT	0,0	0	10	s
P0141	4x8141	Adaptation Speed	- - -	16bits/INT	90	0	300	RPM
P0142	4x8142	Maximum Output Voltage	- - -	16bits/INT	100,0	0	100.0	%

Parameter	Address	Description	Status	Size	Default	Min.	Max.	Unit
P0143	4x8143	Intermediate Output Voltage	- - -	16bits/INT	50,0	0	100.0	%
P0144	4x8144	3Hz Output Voltage	- - -	16bits/INT	8,0	0	100.0	%
P0145	4x8145	Field Weakening Start Speed	- - -	16bits/INT	1800	0	18000	RPM
P0146	4x8146	Intermediate Speed	- - -	16bits/INT	900	0	18000	RPM
P0150	4x8150	Ud V/f Regulation Type	0 = Ramp Hold 1 = Ramp Acceleration	16bits/INT	0	--	--	- - -
P0151	4x8151	Ud V/f Regul. Level	- - -	16bits/INT	--	339	1200	V
P0152	4x8152	Ud Regul. Prop. Gain	- - -	16bits/INT	1,50	0	9.99	--
P0153	4x8153	Dynamic Braking Level	- - -	16bits/INT	--	339	1200	V
P0154	4x8154	Dynamic Braking Resistor	- - -	16bits/INT	0,0	0	500.0	ohm
P0155	4x8155	Dyn. Braking Resist. Power	- - -	16bits/INT	2,60	0.02	650.0	kW
P0156	4x8156	Overload Current 100 %	- - -	16bits/INT	1,05 x Inom-ND	0	2565.0	A
P0157	4x8157	Overload Current 50 %	- - -	16bits/INT	0,9 x Inom-ND	0	2565.0	A
P0158	4x8158	Overload Current 5 %	- - -	16bits/INT	0,65 x Inom-ND	0	2565.0	A
P0159	4x8159	Motor Thermal Class	0 = Class 5 1 = Class 10 2 = Class 15 3 = Class 20 4 = Class 25 5 = Class 30 6 = Class 35 7 = Class 40 8 = Class 45	16bits/INT	1	--	--	- - -
P0160	4x8160	Speed Regul. Setting	0 = Normal 1 = Saturated	16bits/INT	0	--	--	- - -
P0161	4x8161	Speed Prop. Gain	- - -	16bits/INT	7,0	0	63.9	- - -
P0162	4x8162	Speed Integral Gain	- - -	16bits/INT	0,005	0	9.999	- - -
P0163	4x8163	LOC Reference Offset	- - -	16bits/INT	0	-999	999	- - -
P0164	4x8164	REM Reference Offset	- - -	16bits/INT	0	-999	999	- - -
P0165	4x8165	Speed Filter	- - -	16bits/INT	0,012	0.012	1.000	s
P0166	4x8166	Speed Diff. Gain	- - -	16bits/INT	0,00	0	7.99	- - -
P0167	4x8167	Current Proportional Gain	- - -	16bits/INT	0,5	0	1.99	- - -
P0168	4x8168	Current Integral Gain	- - -	16bits/INT	0,010	0	1.999	- - -
P0169	4x8169	Maximum Torque Current +	- - -	16bits/INT	125,0	0	350.0	%
P0170	4x8170	Minimum Torque Current -	- - -	16bits/INT	125,0	0	350.0	%
P0171	4x8171	Torque Current + at Nmax	- - -	16bits/INT	125,0	0	350.0	%
P0172	4x8172	Torque Current - at Nmax	- - -	16bits/INT	125,0	0	350.0	%
P0173	4x8173	Max Torque Curve Type	0 = Ramp 1 = Step	16bits/INT	--	--	--	- - -
P0175	4x8175	Flux Proportional Gain	- - -	16bits/INT	2,0	0	31.9	- - -
P0176	4x8176	Flux Integral Gain	- - -	16bits/INT	0,020	0	9.999	- - -
P0178	4x8178	Rated Flux	- - -	16bits/INT	100	0	120	%
P0180	4x8180	Iq* after the I/f	- - -	16bits/INT	10	0	350	%
P0181	4x8181	Magnetization Mode	0 = General Enable 1 = Run/Stop	16bits/INT	0	--	--	- - -
P0182	4x8182	Speed for I/F Activation	- - -	16bits/INT	18	0	90	RPM
P0183	4x8183	Current in I/F Mode	- - -	16bits/INT	1	0	9	- - -

Parameter	Address	Description	Status	Size	Default	Min.	Max.	Unit
P0184	4x8184	DC Link Regul. Mode	0 = With losses 1 = Without losses 2 = Enable/Disable DIx	16bits/INT	1	--	--	- - -
P0185	4x8185	Ud Regulation Level	- - -	16bits/INT	--	339	1200	V
P0186	4x8186	Ud Proportional Gain	- - -	16bits/INT	18,0	0	63.9	- - -
P0187	4x8187	Ud Integral Gain	- - -	16bits/INT	0,002	0	9.999	- - -
P0188	4x8188	Output V. Prop. Gain	- - -	16bits/INT	0,200	0	7.999	- - -
P0189	4x8189	Output V. Integ. Gain	- - -	16bits/INT	0,001	0	7.999	- - -
P0190	4x8190	Maximum Output Voltage	- - -	16bits/INT	P0400	0	690	V
P0191	4x8191	Encoder Zero Search	0 = Inactive 1 = Active	16bits/INT	0	--	--	- - -
P0192	4x8192	Encoder Zero Search Status	0 = Inactive 1 = Concluded	16bits/INT	0	0	1	- - -
P0200	4x8200	Password	0 = Inactive 1 = Active 2 = Change password	16bits/INT	1	0	2	- - -
P0201	4x8201	Language	0 = Português 1 = English 2 = Español 3 = Deutsch 4 = Français	16bits/INT	0	0	4	- - -
P0202	4x8202	Control Type	0 = V/f 60Hz 1 = V/f 50Hz 2 = V/f Adjustable 3 = Sensorless 4 = Encoder 5 = VVW 6 = PM with Encoder 7 = PM Sensorless	16bits/INT	0	0	7	- - -
P0203	4x8203	Speed Filter	0 = None 1 = PID Controller	16bits/INT	0	0	1	- - -
P0204	4x8204	Load/Save Parameters	0 = Not Used 1 = Not Used 2 = Reset P0045 3 = Reset P0043 4 = Reset P0044 5 = Load WEG 60Hz 6 = Load WEG 50Hz 7 = Load User 1 8 = Load User 2 9 = Load User 3 10 = Saver User 1 11 = Saver User 2 12 = Saver User 3	16bits/INT	0	0	12	- - -

Parameter	Address	Description	Status	Size	Default	Min.	Max.	Unit
P0205	4x8205	Read Parameter Sel. 1	0 = Inactive 1 = Speed Reference # 2 = Motor Speed # 3 = Motor Current # 4 = DC Link Voltage # 5 = Motor Frequency # 6 = Output Voltage # 7 = Motor Torque # 8 = Output Power# 9 = Process Var. # 10 = PID Setpoint # 11 = Speed Reference - 12 = Motor Speed - 13 = Motor Current - 14 = DC Link Voltage - 15 = Motor Frequency - 16 = Output Voltage - 17 = Motor Torque - 18 = Output Power - 19 = Process Var. - 20 = PID Setpoint - 21 = Reserved P1010 # 22 = Reserved P1011 # 23 = Reserved P1012 # 24 = Reserved P1013 # 25 = Reserved P1014 # 26 = Reserved P1015 # 27 = Reserved P1016 # 28 = Reserved P1017 # 29 = Reserved P1018 # 30 = Reserved P1019 # 31 = ALC11 P1300 # 32 = ALC11 P1301 # 33 = ALC11 P1302 # 34 = ALC11 P1303 # 35 = ALC11 P1304 # 36 = ALC11 P1305 # 37 = ALC11 P1306 # 38 = ALC11 P1307 # 39 = ALC11 P1308 # 40 = ALC11 P1309 # 41 = ALC11 Operation Mode	16bits/INT	2	0	40	- - -
P0206	4x8206	Read Parameter Sel. 2	See options in P0205	16bits/INT	3	0	40	- - -
P0207	4x8207	Read Parameter Sel. 3	See options in P0205	16bits/INT	41	0	41	- - -
P0208	4x8208	Ref. Scale Factor	- - -	16bits/INT	1800	0	18000	- - -
P0209	4x8209	Ref. Eng. Unit 1	- - -	16bits/INT	114	32	127	- - -
P0210	4x8210	Ref. Eng. Unit 2	- - -	16bits/INT	112	32	127	- - -
P0211	4x8211	Ref. Eng. Unit 3	- - -	16bits/INT	109	32	127	- - -
P0212	4x8212	Ref. Indication Form	0 = wxyz 1 = wxy.z 2 = wx.yz 3 = w.xyz	16bits/INT	0	0	3	- - -
P0213	4x8213	Full Scale Read 1	- - -	16bits/INT	100,0	0	200.0	%
P0214	4x8214	Full Scale Read 2	- - -	16bits/INT	100,0	0	200.0	%
P0215	4x8215	Full Scale Read 3	- - -	16bits/INT	100,0	0	200.0	%
P0216	4x8216	HMI Display Contrast	- - -	16bits/INT	27	0	37	- - -

Parameter	Address	Description	Status	Size	Default	Min.	Max.	Unit
P0217	4x8217	Zero Speed Disable	0 = OFF 1= ON (N* and N) 2 = ON (N*)	16bits/INT	0	0	2	- - -
P0218	4x8218	Zero Speed Dis. Out	0 = Reference or Speed 1 = Reference	16bits/INT	0	0	1	- - -
P0219	4x8219	Zero Speed Time	- - -	16bits/INT	0	0	999	s
P0220	4x8220	LOC/REM Selection Source	0 = Always LOC 1 = Always REM 2 = LR Key (LOC) 3 = LR Key (REM) 4 = DIx 5 = Serial/USB LOC 6 = Serial/USB REM 7 = Anybus-CC LOC 8 = Anybus-CC REM 9 = CO/DN/DP LOC 10 = CO/DN/DP REM 11 = Reserved LOC 12 = Reserved REM 13 = ALC11 LOC 14 = ALC11 REM	16bits/INT	2	0	14	- - -
P0221	4x8221	LOC Reference Sel.	0 = HMI 1 = AI1 2 = AI2 3 = AI3 4 = AI4 5 = Sum AIs > 0 6 = Sum AIs 7 = E.P. 8 = Multispeed 9 = Serial/USB 10 = Anybus-CC 11 = CANop/DNet/DP 12 = Reserved 13 = ALC11	16bits/INT	0	0	13	- - -
P0222	4x8222	REM Reference Sel.	See options in P0221	16bits/INT	1	0	13	- - -
P0223	4x8223	LOC FWD/REV Selection	0 = Forward 1 = Reverse 2 = FR Key (FWD) 3 = FR Key (REV) 4 = DIx 5 = Serial/USB (FWD) 6 = Serial/USB (REV) 7 = Anybus-CC (FWD) 8 = Anybus-CC (REV) 9 = CO/DN/DP (FWD) 10 = CO/DN/DP (REV) 11 = Polarity AI4 12 = Reserved (FWD) 13 = Reserved (REV) 14 = Polarity AI2 15 = ALC11 (FWD) 16 = ALC11 (REV)	16bits/INT	2	0	16	- - -

Parameter	Address	Description	Status	Size	Default	Min.	Max.	Unit
P0224	4x8224	LOC Run/Stop Selection	0 = I,O Keys 1 = DIx 2 = Serial/USB 3 = Anybus-CC 4 = CANop/DNet/DP 5 = Reserved 6 = ALC11	16bits/INT	0	0	6	- - -
P0225	4x8225	JOG LOC Selection	0 = Inactive 1 = JOG key 2 = DIx 3 = Serial/USB 4 = Anybus-CC 5 = CANop/DNet/DP 6 = Reserved 7 = ALC11	16bits/INT	1	0	7	- - -
P0226	4x8226	REM FWD/REV Sel.	See options in P0223	16bits/INT	4	0	16	- - -
P0227	4x8227	REM Run/Stop Selection	See options in P0224	16bits/INT	1	0	6	- - -
P0228	4x8228	REM JOG Selection	See options in P0225	16bits/INT	2	0	7	- - -
P0229	4x8229	Stop Mode Selection	0 = By Ramp 1 = By Inertia 2 = Quick Stop 3 = By Ramp Iq=0 4 = Quick Stop Iq=0	16bits/INT	0	0	4	- - -
P0230	4x8230	Dead Zone (AIs)	0 = Inactive 1 = Active	16bits/INT	0	0	1	- - -
P0231	4x8231	AI1 Signal Function	0 = Speed Reference 1 = N* without Ramp 2 = Max. Torque Current 3 = Process Var. 4 = PTC 5 = Not Used 6 = Not Used 7 = ALC Use	16bits/INT	0	0	7	- - -
P0232	4x8232	AI1 Gain	- - -	16bits/INT	1,000	0	9.999	- - -
P0233	4x8233	AI1 Input Signal	0 = 0 to 10 V/20 mA 1 = 4 to 20 mA 2 = 10 V/20 mA to 0 3 = 20 to 4 mA	16bits/INT	0	0	3	- - -
P0234	4x8234	AI1 Offset	- - -	16bits/INT	0,00	-100.00	100.00	%
P0235	4x8235	AI1 Filter	- - -	16bits/INT	0,00	0	16.00	S
P0236	4x8236	AI2 Signal Function	0 = Speed Reference 1 = N* without Ramp 2 = Max. Torque Current 3 = Process Var. 4 = PTC 5 = Not Used 6 = Not Used 7 = ALC Use	16bits/INT	0	0	7	- - -
P0237	4x8237	AI2 Gain	- - -	16bits/INT	1,000	0	9.999	- - -
P0238	4x8238	AI2 Input Signal	0 = 0 to 10 V/20 mA 1 = 4 to 20 mA 2 = 10 V/20 mA to 0 3 = 20 to 4 mA	16bits/INT	0	0	3	- - -
P0239	4x8239	AI2 Offset	- - -	16bits/INT	0,00	-100.00	100.00	%
P0240	4x8240	AI2 Filter	- - -	16bits/INT	0,00	0	16.00	s

Parameter	Address	Description	Status	Size	Default	Min.	Max.	Unit
P0241	4x8241	AI3 Signal Function	0 = Speed Reference 1 = N* without Ramp 2 = Max. Torque Current 3 = Process Var. 4 = PTC 5 = Not Used 6 = Not Used 7 = ALC Use	16bits/INT	0	0	7	- - -
P0242	4x8242	AI3 Gain	- - -	16bits/INT	1,000	0	9.999	- - -
P0243	4x8243	AI3 Input Signal	0 = 0 to 10 V/20 mA 1 = 4 to 20 mA 2 = 10 V/20 mA to 0 3 = 20 to 4 mA	16bits/INT	0	0	3	- - -
P0244	4x8244	AI3 Offset	- - -	16bits/INT	0,00	-100.00	100.00	%
P0245	4x8245	AI3 Filter	- - -	16bits/INT	0,00	0	16.00	s
P0246	4x8246	AI4 Signal Function	0 = Speed Reference 1 = N* without Ramp 2 = Max. Torque Current 3 = Process Var. 4 = PTC 5 = Not Used 6 = Not Used 7 = ALC Use	16bits/INT	0	0	7	- - -
P0247	4x8247	AI4 Gain	- - -	16bits/INT	1,000	0	9.999	- - -
P0248	4x8248	AI4 Input Signal	0 = 0 to 10 V/20 mA 1 = 4 to 20 mA 2 = 10 V/20 mA to 0 3 = 20 to 4 mA	16bits/INT	0	0	3	- - -
P0249	4x8249	AI4 Offset	- - -	16bits/INT	0,00	-100.00	100.00	%
P0250	4x8250	AI4 Filter	- - -	16bits/INT	0,00	0	16.00	S
P0251	4x8251	AO1 Function	0 = Speed Reference 1 = Total Reference 2 = Real Speed 3 = Torque Current Reference 4 = Torque Current 5 = Output Current 6 = Process Var. 7 = Active Current 8 = Output Power 9 = PID Setpoint 10 = Torque Current > 0 11 = Motor Torque 12 = Reserved 13 = PTC 14 = Not Used 15 = Not Used 16 = Motor Ixt 17 = Encoder Speed 18 = P0696 Content 19 = P0697 Content 20 = P0698 Content 21 = P0699 Content 22 = ALC11 23 = Id* Current	16bits/INT	2	0	23	- - -
P0252	4x8252	AO1 Gain	- - -	16bits/INT	1,000	0	9.999	- - -

Parameter	Address	Description	Status	Size	Default	Min.	Max.	Unit
P0253	4x8253	AO1 Signal Type	0 = 0 to 10 V/20 mA 1 = 4 to 20 mA 2 = 10 V/20 mA to 0 3 = 20 to 4 mA	16bits/INT	0	0	3	- - -
P0254	4x8254	AO2 Function	See options in P0251	16bits/INT	2	0	23	- - -
P0255	4x8255	AO2 Gain	- - -	16bits/INT	1,000	0	9.999	- - -
P0256	4x8256	AO2 Signal Type	See options in P0253	16bits/INT	0	0	3	- - -
P0263	4x8263	DI1 Function	0 = Not Used 1 = Run/Stop 2 = General Enable 3 = Quick Stop 4 = Forward 5 = Reverse 6 = Start 7 = Stop 8 = FWD/REV 9 = LOC/REM 10 = JOG 11 = Increase P.E. 12 = Decrease P.E. 13 = Not Used 14 = 2nd Ramp 15 = Speed/Torque 16 = JOG+ 17 = JOG- 18 = No External Alarm 19 = No External Fault 20 = Reset 21 = ALC Use 22 = Manual/Autom. 23 = Not Used 15 = Disab. FlyStart 16 = DC Link Regul. 26 = Prog. Off 27 = Load User 1/2 28 = Load User 3 29 = Timer DO2 30 = Timer DO3 31 = Trace Function	16bits/INT	2	0	31	- - -
P0264	4x8264	DI2 Function	See options in P0263	16bits/INT	9	0	31	- - -
P0265	4x8265	DI3 Function	See options in P0263	16bits/INT	21	0	31	- - -
P0266	4x8266	DI4 Function	See options in P0263	16bits/INT	23	0	31	- - -
P0267	4x8267	DI5 Function	See options in P0263	16bits/INT	23	0	31	- - -
P0268	4x8268	DI6 Function	See options in P0263	16bits/INT	18	0	31	- - -

Parameter	Address	Description	Status	Size	Default	Min.	Max.	Unit
P0275	4x8275	DO1 Function (RL1)	0 = Not Used 1 = N* > Nx 2 = N > Nx 3 = N < Ny 4 = N = N* 5 = Zero Speed 6 = Is > Ix 7 = Is < Ix 8 = Torque > Tx 9 = Torque < Tx 10 = Remote 11 = Run 12 = Ready 13 = No Fault 14 = No F070 15 = No F071 16 = No F006/21/22 17 = No F051/54/57 18 = No F072 19 = 4-20 mA OK 20 = P0695 Content 21 = Forward 22 = Proc. V > VPx 23 = Proc. V < VPy 24 = Ride-Through 25 = Pre-Charge OK 26 = With Fault 27 = Hours Enab > Hx 28 = Reserved 29 = Not Used 30 = N>Nx and Nt>Nx 31 = F > Fx (1) 32 = F > Fx (2) 33 = STO 34 = No F160 35 = No Alarm 36 = No Fault/Alarm 37 = ALC11 38 = No IOE Fault 39 = No IOE Alarm 40 = No IOE Cable 41 = No A/ IOE Cable 42 = No F/ IOE Cable	16bits/INT	0	0	42	- - -
P0276	4x8276	DO2 Function (RL2)	See options in P0275	16bits/INT	11	0	42	- - -
P0277	4x8277	DO3 Function (RL3)	See options in P0275	16bits/INT	28	0	42	- - -
P0281	4x8281	Fx Frequency	- - -	16bits/INT	4,0	0	300.0	Hz
P0282	4x8282	Fx Hysteresis	- - -	16bits/INT	2,0	0	15.0	Hz
P0283	4x8283	DO2 ON Time	- - -	16bits/INT	0,0	0	300.0	s
P0284	4x8284	DO2 OFF Time	- - -	16bits/INT	0,0	0	300.0	s
P0285	4x8285	DO3 ON Time	- - -	16bits/INT	0,0	0	300.0	s
P0286	4x8286	DO3 OFF Time	- - -	16bits/INT	0,0	0	300.0	s
P0287	4x8287	Nx/Ny Hysteresis	- - -	16bits/INT	18	0	900	RPM
P0288	4x8288	Nx Speed	- - -	16bits/INT	120	0	18000	RPM
P0289	4x8289	Ny Speed	- - -	16bits/INT	1800	0	18000	RPM
P0290	4x8290	Ix Current	- - -	16bits/INT	1,0 x Inom-ND	0	3420.0	A
P0291	4x8291	Zero Speed	- - -	16bits/INT	18	0	18000	RPM

Parameter	Address	Description	Status	Size	Default	Min.	Max.	Unit
P0292	4x8292	N = N* Band	- - -	16bits/INT	18	0	18000	RPM
P0293	4x8293	Tx Torque	- - -	16bits/INT	100	0	200	%
P0294	4x8294	Hx Hours	- - -	16bits/INT	4320h	0	6553	h
P0295	4x8295	ND/HD VFD Rated Current	0 = 3,6 A / 3,6 A 1 = 5 A / 5 A 2 = 6 A / 5 A 3 = 7 A / 5,5 A 4 = 7 A / 7 A 5 = 10 A / 8 A 6 = 10 A / 10 A 7 = 13 A / 11 A 8 = 13,5 A / 11 A 9 = 16 A / 13 A 10 = 17 A / 13,5 A 11 = 24 A / 19 A 12 = 24 A / 20 A 13 = 28 A / 24 A 14 = 31 A / 25 A 15 = 33,5 A / 28 A 16 = 38 A / 33 A 17 = 45 A / 36 A 18 = 45 A / 38 A 19 = 54 A / 45 A 20 = 58,5 A / 47 A 21 = 70 A / 56 A 22 = 70,5 A / 61 A 23 = 86 A / 70 A 24 = 88 A / 73 A 25 = 105 A / 86 A 26 = 427 A / 340 A 27 = 470 A / 380 A 28 = 811 A / 646 A 29 = 893 A / 722 A 30 = 1217 A / 969 A 31 = 1340 A / 1083 A 32 = 1622 A / 1292 A 33 = 1786 A / 1444 A 34 = 2028 A / 1615 A 35 = 2232 A / 1805 A 36 = 2 A / 2 A 37 = 640 A / 515 A 38 = 1216 A / 979 A 39 = 14x824 A / 1468 A 40 = 2432 A / 1957 A 41 = 3040 A / 2446 A 42 = 600 A / 515 A 43 = 1140 A / 979 A 44 = 1710 A / 1468 A 45 = 2280 A / 1957 A 46 = 2850 A / 2446 A 47 = 105 A / 88 A 48 = 142 A / 115 A 49 = 180 A / 142 A 50 = 211 A / 180 A 51 = 242 A / 211 A 52 = 312 A / 242 A 53 = 370 A / 312 A 54 = 477 A / 370 A 55 = 515 A / 477 A 56 = 601 A / 515 A 57 = 720 A / 560 A	16bits/INT	--	0	107	- - -

			58 = 2,9 A / 2,7 A 59 = 4,2 A / 3,8 A 60 = 7 A / 6,5 A 61 = 8,5 A / 7 A 62 = 10 A / 9 A 63 = 11 A / 9 A 64 = 12 A / 10 A 65 = 15 A / 13 A 66 = 17 A / 17 A 67 = 20 A / 17 A 68 = 22 A / 19 A 69 = 24 A / 21 A 70 = 27 A / 22 A 71 = 30 A / 24 A 72 = 32 A / 27 A 73 = 35 A / 30 A 74 = 44 A / 36 A 75 = 46 A / 39 A 76 = 53 A / 44 A 77 = 54 A / 46 A 78 = 63 A / 53 A 79 = 73 A / 61 A 80 = 80 A / 66 A 81 = 100 A / 85 A 82 = 107 A / 90 A 83 = 108 A / 95 A 84 = 125 A / 107 A 85 = 130 A / 108 A 86 = 150 A / 122 A 87 = 147 A / 127 A 88 = 170 A / 150 A 89 = 195 A / 165 A 90 = 216 A / 180 A 91 = 289 A / 240 A 92 = 259 A / 225 A 93 = 315 A / 289 A 94 = 312 A / 259 A 95 = 365 A / 315 A 96 = 365 A / 312 A 97 = 435 A / 357 A 98 = 428 A / 355 A 99 = 472 A / 388 A 100 = 700 A / 515 A 101 = 1330 A / 979 A 102 = 1995 A / 1468 A 103 = 2660 A / 1957 A 104 = 3325 A / 2446 A 105 = 760 A / 600 A 106 = 760 A / 560 A 107 = 226 A / 180 A					

Parameter	Address	Description	Status	Size	Default	Min.	Max.	Unit
P0296	4x8296	Line Rated Voltage	0 = 200 - 240 V 1 = 380 V 2 = 400 - 415 V 3 = 440 - 460 V 4 = 480 V 5 = 500 - 525 V 6 = 550 - 575 V 7 = 600 V 8 = 660 - 690 V	16bits/INT	According to inverter model	0	8	- - -
P0297	4x8297	Switching Frequency	0 = 1.25 kHz 1 = 2.5 kHz 2 = 5.0 kHz 3 = 10.0 kHz 4 = 2.0 kHz	16bits/INT	According to inverter model	0	4	- - -
P0298	4x8298	Application	0 = Normal Duty (ND) 1 = Heavy Duty (HD)	16bits/INT	0	0	1	- - -
P0299	4x8299	DC-Braking Start Time	- - -	16bits/INT	0,0	0	15.0	s
P0300	4x8300	DC-Braking Stop Time	- - -	16bits/INT	0,0	0	15.0	s
P0301	4x8301	Starting Speed	- - -	16bits/INT	30	0	450	RPM
P0302	4x8302	DC-Braking Voltage	- - -	16bits/INT	2,0	0	10.0	%
P0303	4x8303	Skip Speed 1	- - -	16bits/INT	600	0	18000	RPM
P0304	4x8304	Skip Speed 2	- - -	16bits/INT	900	0	18000	RPM
P0305	4x8305	Skip Speed 1	- - -	16bits/INT	1200	0	18000	RPM
P0306	4x8306	Skip Band	- - -	16bits/INT	0	0	750	RPM
P0308	4x8308	Serial Address	- - -	16bits/INT	1	1	247	- - -
P0310	4x8310	Serial Baud Rate	0 = 9600 bits/s 1 = 19200 bits/s 2 = 38400 bits/s 3 = 57600 bits/s	16bits/INT	0	0	3	- - -
P0311	4x8311	Serial Byte Configuration	0 = 8bits/Bool, no, 1 1 = 8bits/Bool, even, 1 2 = 8bits/Bool, odd, 1 3 = 8bits/Bool, no, 2 1 = 8bits/Bool, even, 2 5 = 8bits/Bool, odd, 2	16bits/INT	3	0	5	- - -
P0312	4x8312	Serial Protocol	1 = TP 2 = Modbus RTU	16bits/INT	2	1	2	- - -
P0313	4x8313	Communication Error Action	0 = Inactive 1 = Stop by Ramp 2 = General Disable 3 = Go to LOC 4 = LOC Keeping Enable 5 = Cause Fault	16bits/INT	1	0	5	- - -
P0314	4x8314	Watchdog Serial	- - -	16bits/INT	0,0	0	999.0	s
P0315	4x8315	LOCAL/REMOTE Transition Action	0 = Keep status 1 = Stop motor	16bits/INT	0	0	1	- - -
P0316	4x8316	Serial Interface Status	0 = Inactive 1 = Active 2 = Watchdog Error	16bits/INT	RO	0	2	- - -
P0320	4x8320	FlyStart/Ride-Through	0 = Inactive 1 = Flying Start 2 = FS/RT 3 = Ride-Through	16bits/INT	2	0	3	- - -
P0321	4x8321	DC Link Power Loss	- - -	16bits/INT	--	178	846	V
P0322	4x8322	DC Link Ride-Through	- - -	16bits/INT	--	178	846	V

Quick Reference of Parameters / Communication Table

Parameter	Address	Description	Status	Size	Default	Min.	Max.	Unit
P0323	4x8323	DC Link Power Back	- - -	16bits/INT	--	178	846	V
P0324	4x8324	Action for ALC 11 Communication Error	0 = Inactive 1 = Stop by Ramp 2 = General Disable 3 = Go to LOC 4 = Cause Fault	16bits/INT	0	0	4	- - -
P0325	4x8325	RT Proportional Gain	- - -	16bits/INT	22,8	0	63.9	- - -
P0326	4x8326	RT Integral Gain	- - -	16bits/INT	0,128	0	9.999	- - -
P0327	4x8327	FS I/F Current Ramp	- - -	16bits/INT	0,070	0	1.000	s
P0328	4x8328	Flying Start Filter	- - -	16bits/INT	0,085	0	1.000	s
P0329	4x8329	FS I/F Frequency Ramp	- - -	16bits/INT	6,0	2.0	50.0	s
P0331	4x8331	Voltage Ramp	- - -	16bits/INT	2,0	0.2	60.0	s
P0332	4x8332	Dead Time	- - -	16bits/INT	1,0	0.1	10.0	s
P0340	4x8340	Auto-Reset Time	- - -	16bits/INT	0	0	255	s
P0342	4x8342	Motor Unbal.Curr.Conf	0 = Inactive 1 = Active	16bits/INT	0	0	1	- - -
P0343	4x8343	Ground Fault Config.	0 = Inactive 1 = Active	16bits/INT	1	0	1	- - -
P0344	4x8344	Current Lim. Conf.	0 = Hold - FL ON 1 = Decel. - LR ON 2 = Hold - Fl OFF 3 = Decel.- FL OFF	16bits/INT	3	0	3	- - -
P0348	4x8348	Motor Overload Configuration	0 = Inactive 1 = Fault/Alarm 2 = Fault 3 = Alarm	16bits/INT	1	0	3	- - -
P0349	4x8349	Ixt Alarm Level	- - -	16bits/INT	85	70	100	%
P0350	4x8350	IGBT Overload Setting	0 = F w/rd. Fs 1 = F/A w/rd. Fs 2 = F no/rd. Fs 3 = F/A no/rd. Fs	16bits/INT	1	0	3	- - -
P0351	4x8351	Motor Overtemp. Setting	0 = Inactive 1 = Fault/Alarm 2 = Fault 3 = Alarm	16bits/INT	1	0	3	- - -
P0352	4x8352	Fan Setting	0 = VD-OFF, VI-OFF 1 = VD-ON, VI-ON 2 = VD-CT, VI-CT 3 = VD-CT, VI-OFF 4 = VD-CT, VI-ON 5 = VD-ON, VI-OFF 6 = VD-ON, VI-CT 7 = VD-OFF, VI-ON 8 = VD-OFF, VI-CT	16bits/INT	2	0	8	- - -
P0353	4x8353	IGBTs/Air Overtmp. Setting	0 = D-F/A, AR-F/A 1 = D-F/A, AR-F 2 = D-F, AR-F/A 3 = D-F, AR-F	16bits/INT	0	0	3	- - -
P0354	4x8354	Fan Speed Setting	0 = Inactive 1 = Fault	16bits/INT	1	0	1	- - -
P0355	4x8355	Fault F185 Setting	0 = Inactive 1 = Active	16bits/INT	1	0	1	- - -
P0356	4x8356	Dead Time Compensation	0 = Inactive 1 = Active	16bits/INT	1	0	1	- - -

Parameter	Address	Description	Status	Size	Default	Min.	Max.	Unit
P0357	4x8357	Line Phase Loss Time	- - -	16bits/INT	3	0	60	s
P0358	4x8358	Encoder Fault Setting	0 = OFF 1 = F67 ON 2 = F79 ON 3 = F67, F79 ON	16bits/INT	3	0	3	- - -
P0359	4x8359	Motor Current Stabilization	0 = Inactive 1 = Active	16bits/INT	0	0	1	- - -
P0372	4x8372	DC-Braking Curr Sless	- - -	16bits/INT	40,0	0	90.0	%
P0373	4x8373	PTC1 Sensor Type	0 = Single PTC 1 = Triple PTC	16bits/INT	1	0	1	- - -
P0374	4x8374	F/A Sensor 1 Setting	0 = Inactive 1 = Cable/Alarm Fault 2 = Cable Fault 3 = Alarm/Cable 4 = Fault/Alarm 5 = Fault 6 = Alarm 7 = Cable Alarm	16bits/INT	1	0	7	- - -
P0375	4x8375	F/A Temperature Sensor 1	- - -	16bits/INT	130	-20	200	° C
P0376	4x8376	PTC2 Sensor Type	0 = Single PTC 1 = Triple PTC	16bits/INT	1	0	1	- - -
P0377	4x8377	F/A Sensor 2 Setting	See options in P0374	16bits/INT	1	0	7	- - -
P0378	4x8378	F/A Temperature Sensor 2	- - -	16bits/INT	130	-20	200	° C
P0379	4x8379	PTC3 Sensor Type	0 = Single PTC 1 = Triple PTC	16bits/INT	1	0	1	- - -
P0380	4x8380	F/A Sensor 3 Setting	See options in P0374	16bits/INT	1	0	7	- - -
P0381	4x8381	F/A Temperature Sensor 3	- - -	16bits/INT	130	-20	200	° C
P0382	4x8382	PTC4 Sensor Type	0 = Single PTC 1 = Triple PTC	16bits/INT	1	0	1	- - -
P0383	4x8383	F/A Sensor 4 Setting	0 = Inactive 1 = Cable/Alarm Fault 2 = Cable Fault 3 = Alarm/Cable 4 = Fault/Alarm 5 = Fault 6 = Alarm 7 = Cable Alarm	16bits/INT	1	0	7	- - -
P0384	4x8384	F/A Temperature Sensor 4	- - -	16bits/INT	130	-20	200	° C
P0385	4x8385	PTC5 Sensor Type	0 = Single PTC 1 = Triple PTC	16bits/INT	1	0	1	- - -
P0386	4x8386	F/A Sensor 5 Setting	See options in P0383	16bits/INT	1	0	7	- - -
P0387	4x8387	F/A Temperature Sensor 5	- - -	16bits/INT	130	-20	200	° C
P0388	4x8388	Temperature Sensor 1	- - -	16bits/INT	RO	-20	200	° C
P0389	4x8389	Temperature Sensor 2	- - -	16bits/INT	RO	-20	200	° C
P0390	4x8390	Temperature Sensor 3	- - -	16bits/INT	RO	-20	200	° C
P0391	4x8391	Temperature Sensor 4	- - -	16bits/INT	RO	-20	200	° C
P0392	4x8392	Temperature Sensor 5	- - -	16bits/INT	RO	-20	200	° C
P0393	4x8393	Sensors Highest Temperature	- - -	16bits/INT	RO	-20	200	° C
P0397	4x8397	Slip Compens. Regen.	0 = Inactive 1 = Active Motorizing/ Regenerating 2 = Active Motorizing 3 = Active Regenerating	16bits/INT	1	0	3	- - -
P0398	4x8398	Motor Service Factor	- - -	16bits/INT	1,00	1	1.50	- - -

Parameter	Address	Description	Status	Size	Default	Min.	Max.	Unit
P0399	4x8399	Motor Rated Efficiency	- - -	16bits/INT	67,9	50	99.9	%
P0400	4x8400	Motor Rated Voltage	- - -	16bits/INT	--	0	690	V
P0401	4x8401	Motor Rated Current	- - -	16bits/INT	1,0 x Inom-ND	0	2223.0	A
P0402	4x8402	Motor Rated Speed	- - -	16bits/INT	1750	0	18000	RPM
P0403	4x8403	Motor Rated Frequency	- - -	16bits/INT	60	0	300	Hz
P0404	4x8404	Motor Rated Power	0 = 0.33 CV 1 = 0.50 CV 2 = 0.75 CV 3 = 1.0 CV 4 = 1.5 CV 5 = 2.0 CV 6 = 3.0 CV 7 = 4.0 CV 8 = 5.0 CV 9 = 5.5 CV 10 = 6.0 CV 11 = 7.5 CV 12 = 10.0 CV 13 = 12.5 CV 14 = 15.0 CV 15 = 20.0 CV 16 = 25.0 CV 17 = 30.0 CV 18 = 40.0 CV 19 = 50.0 CV 20 = 60.0 CV 21 = 75.0 CV 22 = 100.0 CV 23 = 125.0 CV 24 = 150.0 CV 25 = 175.0 CV 26 = 180.0 CV 27 = 200.0 CV 28 = 220.0 CV 29 = 250.0 CV 30 = 270.0 CV 31 = 300.0 CV 32 = 350.0 CV 33 = 380.0 CV 34 = 400.0 CV 35 = 430.0 CV 36 = 440.0 CV 37 = 450.0 CV 38 = 475.0 CV 39 = 500.0 CV 40 = 540.0 CV 41 = 600.0 CV 42 = 620.0 CV 43 = 670.0 CV 44 = 700.0 CV 45 = 760.0 CV 46 = 800.0 CV 47 = 850.0 CV 48 = 900.0 CV 49 = 1000.0 CV 50 = 1100.0 CV 51 = 1250.0 CV 52 = 1400.0 CV 53 = 1500.0 CV 54 = 1600.0 CV 55 = 1800.0 CV 56 = 2000.0 CV 57 = 2300.0 CV 58 = 2500.0 CV 59 = 2900.0 CV 60 = 3400.0 CV	16bits/INT	Motorma x-ND	0	60	- - -

Parameter	Address	Description	Status	Size	Default	Min.	Max.	Unit
P0405	4x8405	Encoder Pulse Number	- - -	16bits/INT	1024	100	9999	ppr
P0406	4x8406	Motor Ventilation	0 = Self-ventilated 1 = Separate Vent. 2 = Optimal Flux 3 = Extended Protection	16bits/INT	0	0	3	- - -
P0407	4x8407	Motor Rated Power Factor	- - -	16bits/INT	0,68	0.5	0.99	%
P0409	4x8409	Stator Resistance	- - -	16bits/INT	0,000	0	9.999	ohm
P0410	4x8410	Magnetization Current	- - -	16bits/INT	Inom-ND	0	2137.5	A
P0411	4x8411	Leakage Inductance	- - -	16bits/INT	0,00	0	99.99	mH
P0412	4x8412	Tr Time Constant	- - -	16bits/INT	0,000	0	9.999	s
P0413	4x8413	Tm Time Constant	- - -	16bits/INT	0,00	0	99.99	s
P0431	4x8431	Number of Poles	- - -	16bits/INT	6	2	24	- - -
P0433	4x8433	Lq Inductance	- - -	16bits/INT	0,00	0	100.00	mH
P0434	4x8434	Ld Inductance	- - -	16bits/INT	0,00	0	100.00	mH
P0435	4x8435	Ke Time Constant	- - -	16bits/INT	100,0	0	600.0	- - -
P0438	4x8438	Iq Proportional Gain	- - -	16bits/INT	0,80	0	1.99	- - -
P0439	4x8439	Iq Integral Gain	- - -	16bits/INT	0,005	0	1.999	- - -
P0440	4x8440	Id Proportional Gain	- - -	16bits/INT	0,50	0	1.99	- - -
P0441	4x8441	Id Integral Gain	- - -	16bits/INT	0,005	0	1.999	- - -
P0520	4x8520	PID Proportional Gain	- - -	16bits/INT	1,000	0	7.999	- - -
P0521	4x8521	PID Integral Gain	- - -	16bits/INT	0,043	0	7.999	- - -
P0522	4x8522	PID Differential Gain	- - -	16bits/INT	0,000	0	3.499	- - -
P0523	4x8523	Tempo de Rampa do PID	- - -	16bits/INT	3,0	0	999.0	s
P0524	4x8524	PID Feedback Sel.	0 = AI1 (P0231) 1 = AI2 (P0236) 2 = AI3 (P0241) 3 = AI4 (P0246)	16bits/INT	1	0	3	- - -
P0525	4x8525	PID Setpoint via HMI	- - -	16bits/INT	0,0	0	100.0	%
P0527	4x8527	PID Action Type	0 = Direct 1 = Reverse	16bits/INT	0	0	1	- - -
P0528	4x8528	VP Scale Factor	- - -	16bits/INT	1000	1	9999	- - -
P0529	4x8529	VP Indication Form	0 = wxyz 1 = wxy.z 2 = wx.yz 3 = w.xyz	16bits/INT	1	0	3	- - -
P0530	4x8530	PV Engineering Unit 1	- - -	16bits/INT	37	32	127	- - -
P0531	4x8531	PV Engineering Unit 2	- - -	16bits/INT	32	32	127	- - -
P0532	4x8532	PV Engineering Unit 3	- - -	16bits/INT	32	32	127	- - -
P0533	4x8533	PVx value	- - -	16bits/INT	90,0	0	100.0	%
P0534	4x8534	PVy value	- - -	16bits/INT	10,0	0	100.0	%
P0535	4x8535	Output N=0 PID	- - -	16bits/INT	0	0	100	%
P0536	4x8536	Automatic Setting P0525	0 = Inactive 1 = Active	16bits/INT	1	0	1	- - -
P0538	4x8538	PVx/PVy Hysteresis	- - -	16bits/INT	1,0	0	5.0	%

Parameter	Address	Description	Status	Size	Default	Min.	Max.	Unit
P0550	4x8550	Trace Trigger Source	0 = Inactive 1 = Speed Reference 2 = Motor Speed 3 = Motor Current 4 = DC Link Voltage 5 = Motor Frequency 6 = Output Voltage 7 = Motor Torque 8 = Process Var. 9 = PID Setpoint 10 = AI1 11 = AI2 12 = AI3 13 = AI4	16bits/INT	0	0	13	- - -
P0551	4x8551	Trace Trigger Value	- - -	16bits/INT	0,0	-100.0	340.0	%
P0552	4x8552	Trace Trigger Condition	0 = P0550* = P0551 1 = P0550* <>P0551 2 = P0550* > P0551 3 = P0550* < P0551 4 = Alarm 5 = Fault 6 = DIx	16bits/INT	5	0	6	- - -
P0553	4x8553	Trace Sampling Period	- - -	16bits/INT	1	1	65535	- - -
P0554	4x8554	Trace Pre-Trigger	- - -	16bits/INT	0	0	100	%
P0559	4x8559	Trace Maximum Memory	- - -	16bits/INT	0	0	100	%
P0560	4x8560	Trace Available Memory	- - -	16bits/INT	RO	0	100	%
P0561	4x8561	CH1: Trace Channel 1	0 = Inactive 1 = Speed Reference 2 = Motor Speed 3 = Motor Current 4 = DC Link Voltage 5 = Motor Frequency 6 = Output Voltage 7 = Motor Torque 8 = Process Var. 9 = PID Setpoint 10 = AI1 11 = AI2 12 = AI3 13 = AI4	16bits/INT	1	0	13	- - -
P0562	4x8562	CH2: Trace Channel 2	See options in P0561	16bits/INT	2	0	13	- - -
P0563	4x8563	CH3: Trace Channel 3	See options in P0561	16bits/INT	3	0	13	- - -
P0564	4x8564	CH4: Trace Channel 4	See options in P0561	16bits/INT	0	0	13	- - -
P0571	4x8571	Start Trace	0 = Inactive 1 = Active	16bits/INT	0	0	1	- - -
P0572	4x8572	Trace Trig. Day/Month	- - -	16bits/INT	RO	00/00	31/12	- - -
P0573	4x8573	Trace Trig. Year	- - -	16bits/INT	RO	00	99	- - -
P0574	4x8574	Trace Trig. Hour	- - -	16bits/INT	RO	00:00	23:59	- - -
P0575	4x8575	Sec. Trace Trigger	- - -	16bits/INT	RO	00	59	- - -
P0576	4x8576	Trace Function Status	0 = Inactive 1 = Waiting 2 = Trigger 3 = Concluded	16bits/INT	RO	0	3	- - -

Quick Reference of Parameters / Communication Table

Parameter	Address	Description	Status	Size	Default	Min.	Max.	Unit
P0680	4x8680	Logical Status	Bit 0 to 3 = Reserved Bit 4 = In Fast Stop Bit 5 = 2nd Ramp Bit 6 = Configuration Mode Bit 7 = Alarm Bit 8 = Running Bit 9 = Enabled Bit 10 = Forward Bit 11 = JOG Bit 12 = Remote Bit 13 = Undervoltage Bit 14 = Automatic Bit 15 = Fault	16bits/INT	RO	--	--	- - -
P0681	4x8681	Speed 13 bits	- - -	16bits/INT	RO	-32768	32767	- - -
P0682	4x8682	USB/Serial Control	Bit 0 = Ramp Enable Bit 1 = General Enable Bit 2 = Run Forward Bit 3 = JOG Enable Bit 4 = Remote Bit 5 = 2nd Ramp Bit 6 = Reserved Bit 7 = Fault Reset Bit 8 to 15 = Reserved	16bits/INT	RO	--	--	- - -
P0683	4x8683	Serial /USB Speed Ref.	- - -	16bits/INT	RO	-32768	32767	- - -
P0684	4x8684	CO/DN/DP Control	See options in P0682	16bits/INT	RO	--	--	- - -
P0685	4x8685	CO/DN/DP Speed Ref.	- - -	16bits/INT	RO	-32768	32767	- - -
P0686	4x8686	Anybus-CC Control	See options in P0682	16bits/INT	RO	--	--	- - -
P0687	4x8687	Anybus-CC Speed Ref.	- - -	16bits/INT	RO	-32768	32767	- - -
P0695	4x8695	DOx Value	Bit 0 = DO1 Bit 1 = DO2 Bit 2 = DO3 Bit 3 = DO4 Bit 4 = DO5	16bits/INT	RO	--	--	- - -
P0696	4x8696	AOx Value 1	- - -	16bits/INT	RO	-32768	32767	- - -
P0697	4x8697	AOx Value 2	- - -	16bits/INT	RO	-32768	32767	- - -
P0698	4x8698	AOx Value 3	- - -	16bits/INT	RO	-32768	32767	- - -
P0699	4x8699	AOx Value 4	- - -	16bits/INT	RO	-32768	32767	- - -
P0700	4x8700	CAN Protocol	1 = CANopen 2 = DeviceNet	16bits/INT	2	1	2	- - -
P0701	4x8701	CAN address	- - -	16bits/INT	63	0	127	- - -
P0702	4x8702	CAN Baud Rate	0 = 1 Mbps/Auto 1 = Reserved/Auto 2 = 500 Kbps 3 = 250 Kbps 4 = 125 Kbps 5 = 100 Kbps/Auto 6 = 50 Kbps/Auto 7 = 20 Kbps/Auto 8 = 10 Kbps/Auto	16bits/INT	0	0	8	- - -
P0703	4x8703	Bus Off Reset	0 = Manual 1 = Automatic	16bits/INT	1	0	1	- - -

Parameter	Address	Description	Status	Size	Default	Min.	Max.	Unit
P0705	4x8705	CAN Controller Status	0 = Inactive 1 = Auto-Baud 2 = Active CAN 3 = Warning 4 = Error Passive 5 = Bus Off 6 = Not Supplied	16bits/INT	RO	0	6	- - -
P0706	4x8706	CAN RX Telegrams	- - -	16bits/INT	RO	0	65535	- - -
P0707	4x8707	CAN TX Telegrams	- - -	16bits/INT	RO	0	65535	- - -
P0708	4x8708	Bus Off Counter	- - -	16bits/INT	RO	0	65535	- - -
P0709	4x8709	Lost CAN Messages	- - -	16bits/INT	RO	0	65535	- - -
P0710	4x8710	DNet I/O Instances	0 = ODVA Basic 2W 1 = ODVA Extend 2W 2 = Manufacturer Specification 2W 3 = Manufacturer Specification 3W 4 = Manufacturer Specification 4W 5 = Manufacturer Specification 5W 6 = Manufacturer Specification 6W	16bits/INT	0	0	6	- - -
P0711	4x8711	DeviceNet Reading #3	- - -	16bits/INT	RO	-1	1499	- - -
P0712	4x8712	DeviceNet Reading #4	- - -	16bits/INT	RO	-1	1499	- - -
P0713	4x8713	DeviceNet Reading #5	- - -	16bits/INT	RO	-1	1499	- - -
P0714	4x8714	DeviceNet Reading #6	- - -	16bits/INT	RO	-1	1499	- - -
P0715	4x8715	DeviceNet Reading #3	- - -	16bits/INT	-1	-1	1499	- - -
P0716	4x8716	DeviceNet Reading #4	- - -	16bits/INT	-1	-1	1499	- - -
P0717	4x8717	DeviceNet Reading #5	- - -	16bits/INT	-1	-1	1499	- - -
P0718	4x8718	DeviceNet Reading #6	- - -	16bits/INT	-1	-1	1499	- - -
P0719	4x8719	DeviceNet Network Status	0 = Offline 1 = OnLine, Not Connected 2 = Online, Connected 3 = Connection Timed Out 4 = Link Failure 5 = Auto-Baud	16bits/INT	RO	0	5	- - -
P0720	4x8720	DNet Master Status	0 = Run 1 = Idle	16bits/INT	RO	0	1	- - -
P0721	4x8721	CANopen Comm. Status	0 = Inactive 1 = Reserved 2 = Communication Enable 3 = Error Control Enable 4 = Guarding Error 5 = Heartbeat Error	16bits/INT	RO	0	5	- - -
P0722	4x8722	CANopen Node Status	0 = Inactive 1 = Start 2 = Stopped 3 = Operational 4 = Pre-operational	16bits/INT	RO	0	4	- - -

Parameter	Address	Description	Status	Size	Default	Min.	Max.	Unit
P0723	4x8723	Anybus ID	0 = Inactive 1 = RS232 2 = RS422 3 = USB 4 = Serial Server 5 = Bluetooth 6 = Zigbee 7 = Reserved 8 = Reserved 9 = Reserved 10 = RS485 11 = Reserved 12 = Reserved 13 = Reserved 14 = Reserved 15 = Reserved 16 = Profibus DP 17 = DeviceNet 18 = CANopen 19 = EtherNet/IP 10 = DC link 21 = Modbus TCP 22 = Modbus RTU 23 = Profinet IO 24 = Reserved 25 = Reserved	16bits/INT	RO	0	25	- - -
P0724	4x8724	Anybus Communication Status	0 = Inactive 1 = Not supported 2 = Access Error 3 = Offline 4 = Online	16bits/INT	RO	0	4	- - -
P0725	4x8725	Anybus Address	- - -	16bits/INT	0	0	255	- - -
P0726	4x8726	Anybus Baud Rate	- - -	16bits/INT	0	0	3	- - -
P0727	4x8727	Anybus I/O Words	1 = Flexible 2 = 2 Words 3 = 3 Words 4 = 4 Words 5 = 5 Words 6 = 6 Words 7 = 7 Words 8 = 8 Words 9 = ALC11 Card	16bits/INT	2	1	9	- - -
P0728	4x8728	Anybus Reading #3	- - -	16bits/INT	0	0	1499	- - -
P0729	4x8729	Anybus Reading #4	- - -	16bits/INT	0	0	1499	- - -
P0730	4x8730	Anybus Reading #5	- - -	16bits/INT	0	0	1499	- - -
P0731	4x8731	Anybus Reading #6	- - -	16bits/INT	0	0	1499	- - -
P0732	4x8732	Anybus Reading #7	- - -	16bits/INT	0	0	1499	- - -
P0733	4x8733	Anybus Reading #8	- - -	16bits/INT	0	0	1499	- - -
P0734	4x8734	Anybus Writing #3	- - -	16bits/INT	0	0	1499	- - -
P0735	4x8735	Anybus Writing #4	- - -	16bits/INT	0	0	1499	- - -
P0736	4x8736	Anybus Writing #5	- - -	16bits/INT	0	0	1499	- - -
P0737	4x8737	Anybus Writing #6	- - -	16bits/INT	0	0	1499	- - -
P0738	4x8738	Anybus Writing #7	- - -	16bits/INT	0	0	1499	- - -
P0739	4x8739	Anybus Writing #8	- - -	16bits/INT	0	0	1499	- - -

Quick Reference of Parameters / Communication Table

Parameter	Address	Description	Status	Size	Default	Min.	Max.	Unit
P0740	4x8740	Profibus Comm. Status	0 = Inactive 1 = Access Error 2 = Offline 3 = Configuration Error 4 = Parameter Error 5 = Clear Mode 6 = Online	16bits/INT	RO	0	6	- - -
P0741	4x8741	Profibus Data Profile	0 = PROFIdrive 1 = Manufacturer	16bits/INT	1	0	1	- - -
P0742	4x8742	Profibus Reading #3	- - -	16bits/INT	RO	0	1199	- - -
P0743	4x8743	Profibus Reading #4	- - -	16bits/INT	RO	0	1199	- - -
P0744	4x8744	Profibus Reading #5	- - -	16bits/INT	RO	0	1199	- - -
P0745	4x8745	Profibus Reading #6	- - -	16bits/INT	RO	0	1199	- - -
P0746	4x8746	Profibus Reading #7	- - -	16bits/INT	RO	0	1199	- - -
P0747	4x8747	Profibus Reading #8	- - -	16bits/INT	RO	0	1199	- - -
P0748	4x8748	Profibus Reading #9	- - -	16bits/INT	RO	0	1199	- - -
P0749	4x8749	Profibus Reading #10	- - -	16bits/INT	RO	0	1199	- - -
P0750	4x8750	Profibus Writing #3	- - -	16bits/INT	0	0	1199	- - -
P0751	4x8751	Profibus Writing #4	- - -	16bits/INT	0	0	1199	- - -
P0752	4x8752	Profibus Writing #5	- - -	16bits/INT	0	0	1199	- - -
P0753	4x8753	Profibus Writing #6	- - -	16bits/INT	0	0	1199	- - -
P0754	4x8754	Profibus Writing #7	- - -	16bits/INT	0	0	1199	- - -
P0755	4x8755	Profibus Writing #8	- - -	16bits/INT	0	0	1199	- - -
P0756	4x8756	Profibus Writing #9	- - -	16bits/INT	0	0	1199	- - -
P0757	4x8757	Profibus Writing #10	- - -	16bits/INT	0	0	1199	- - -
P0799	4x8799	Delay I/O Update	- - -	16bits/INT	0,0	0	999.0	s
P0800	4x8800	Temp. Phase U Book 1	- - -	16bits/INT	RO	-20.0	150.0	ºC
P0801	4x8801	Temper. Phase V Book 1	- - -	16bits/INT	RO	-20.0	150.0	ºC
P0802	4x8802	Temper. Phase W Book 1	- - -	16bits/INT	RO	-20.0	150.0	ºC
P0803	4x8803	Temper. Phase U Book 2	- - -	16bits/INT	RO	-20.0	150.0	ºC
P0804	4x8804	Temper. Phase V Book 2	- - -	16bits/INT	RO	-20.0	150.0	ºC
P0805	4x8805	Temper. Phase W Book 2	- - -	16bits/INT	RO	-20.0	150.0	ºC
P0806	4x8806	Temper. Phase U Book 3	- - -	16bits/INT	RO	-20.0	150.0	ºC
P0807	4x8807	Temper. Phase V Book 3	- - -	16bits/INT	RO	-20.0	150.0	ºC
P0808	4x8808	Temper. Phase W Book 3	- - -	16bits/INT	RO	-20.0	150.0	ºC
P0809	4x8809	Temper. Phase U Book 4	- - -	16bits/INT	RO	-20.0	150.0	ºC
P0810	4x8810	Temper. Phase V Book 4	- - -	16bits/INT	RO	-20.0	150.0	ºC
P0811	4x8811	Temper. Phase W Book 4	- - -	16bits/INT	RO	-20.0	150.0	ºC
P0812	4x8812	Temper. Phase U Book 5	- - -	16bits/INT	RO	-20.0	150.0	ºC
P0813	4x8813	Temper. Phase V Book 4	- - -	16bits/INT	RO	-20.0	150.0	ºC
P0814	4x8814	Temper. Phase W Book 5	- - -	16bits/INT	RO	-20.0	150.0	ºC
P0832	4x8832	DIM1 Input Function	0 = Not Used 1 = No Ext. Fault IPS 2 = No SisRef Fault 3 = No SobFren Fault 4 = No Sob Ret Fault 5 = No TRtEx Alarm 6 = No RetEx Fault	16bits/INT	0	0	6	- - -
P0833	4x8833	DIM2 Input Function	See the options in P0832	16bits/INT	0	0	6	- - -
P0834	4x8834	DIM1 to DIM2 Status	Bit 0 = DIM1 Bit 1 = DIM2	16bits/INT	--	--	--	- - -

Quick Reference of Parameters / Communication Table

Parameter	Address	Description	Status	Size	Default	Min.	Max.	Unit
P0918	4x8918	Profibus Address	- - -	16bits/INT	1	1	126	- - -
P0922	4x8922	Profibus Teleg. Sel.	1 = Standard Telegram 1 2 = Telegram 100 3 = Telegram 101 4 = Telegram 102 5 = Telegram 103 6 = Telegram 104 7 = Telegram 105 8 = Telegram 106 9 = Telegram 107	16bits/INT	1	1	9	- - -
P0944	4x8944	Fault Counter	- - -	16bits/INT	RO	0	65535	- - -
P0947	4x8947	Fault Number	- - -	16bits/INT	RO	0	65535	- - -
P0963	4x8963	Profibus Baud Rate	0 = 9.6 kbit/s 1 = 19.2 Kbit/s 2 = 93.75 Kbit/s 3 = 187.5 Kbit/s 4 = 500 Kbit/s 5 = Not detected 6 = 1500 Kbit/s 7 = 3000 Kbit/s 8 = 6000 kbit/s 9 = 12000 kbit/s 10 = Reserved 11 = 45.45 kbit/s	16bits/INT	RO	0		- - -
P0964	4x8964	Drive Identification	- - -	16bits/INT	RO	0	65535	- - -
P0965	4x8965	Identification Profile	- - -	16bits/INT	RO	0	65535	- - -
P0967	4x8967	Control Word 1	Bit 0 = Turn Off Bit 1 = Disab. Motor Bit 2 = Fast Stop Bit 3 = Stop Motor Bit 4 = Reset Ramp Bit 5 = Freeze Ramp Bit 6 = Reset Ref. Bit 7 = Reset Fault Bit 8 = Jog 1 Bit 9 = Jog 2 Bit 10 = No ALC Ctrl. Bit 11...15 = Reserved	16bits/INT	RO	0	--	- - -
P0968	4x8968	Status Word 1	Bit 0 = Not Ready to Start Bit 1 = Not Ready to Run Bit 2 = Stopped Bit 3 = No error Bit 4 = Disabled Bit 5 = In fast stop Bit 6 = No power supply Bit 7 = No alarm Bit 8 = Speed out of range Bit 9 = No ctrl. via network Bit 10 = Speed not reached Bit 11...15 = Reserved	16bits/INT	RO	0	--	- - -
P1000	4x9000	SoftPLC Status	- - -	16bits/INT	RO	- - -	- - -	- - -
P1001	4x9001	Command for SOFTPLC	- - -	16bits/INT	RO	- - -	- - -	- - -
P1002	4x9002	Scan Cycle Time	- - -	16bits/INT	RO	RO	RO	RO
P1010	4x9010	Line Pressure Maximum Scale	- - -	16bits/INT	1000.0	0.0	3276.7	psi
P1011	4x9011	Line Pressure Minimum Scale	- - -	16bits/INT	0	0.0	3276.7	psi
P1012	4x9012	High High Line Pressure Setpoint	- - -	16bits/INT	1000.0	0.0	3276.7	psi
P1013	4x9013	High Line Pressure Setpoint	- - -	16bits/INT	1000.0	0.0	3276.7	psi

Quick Reference of Parameters / Communication Table

Parameter	Address	Description	Status	Size	Default	Min.	Max.	Unit
P1014	4x9014	Low Line Pressure Setpoint	- - -	16bits/INT	0	0	9999	psi
P1015	4x9015	Low Low Line Pressure Setpoint	- - -	16bits/INT	0	0	9999	psi
P1016	4x9016	ALC11 Powerup Time	- - -	16bits/INT	25	0	65535	s
P1018	4x9018	Percentage Current	- - -	16bits/INT	0	0	32000	%
P1019	4x9019	Pumping Method	1 = RP 2 = PCP 3 = ESP	16bits/INT	1	1	3	- -
P1023	4x9023	Reserve Parameter	- - -	16bits/INT	0	0	65635	- -
P1024	4x9024	Stabilization Ref. Speed	- - -	16bits/INT	0	25	4x90	RPM
P1025	4x9025	Enables HD Brake Test	0 = Disables Hydraulic Brake Test 1 = Enables Hydraulic Brake Test	16bits/INT	0	0	1	- -
P1026	4x9026	Brake Reverse Speed Ref.	- - -	16bits/INT	0	10	100	RPM
P1027	4x9027	FH Test duration	- - -	16bits/INT	0	1	400	s
P1028	4x9028	FH minimum pressure	- - -	16bits/INT	0	0	100	%
P1029	4x9029	Rev. 1 Speed Ref.	- - -	16bits/INT	0	70	300	RPM
P1030	4x9030	Max. Rev. 2 Speed Ref.	- - -	16bits/INT	0	70	300	RPM
P1031	4x9031	2nd Ramp Active Speed	- - -	16bits/INT	0	90	200	RPM
P1032	4x9032	Rev. 2 End Torque	- - -	16bits/INT	0	0	100.0	%
P1033	4x9033	Reserve Parameter	- - -	16bits/INT	0	0	65635	- - -
P1034	4x9034	Motor Demag. Time	- - -	16bits/INT	0	0	650	s
P1035	4x9035	Flux Stabilization time	- - -	16bits/INT	0	0	650	s
P1036	4x9036	Rev. 1 End. Time	- - -	16bits/INT	0	0	650	s
P1037	4x9037	Rev. 2 End. Time	- - -	16bits/INT	0	0	650	s
P1038	4x9038	Proportional Gain	- - -	16bits/INT	0	0.000	32.000	- - -
P1039	4x9039	Integral Gain	- - -	16bits/INT	0	0.000	32.000	
P1040	4x9040	Reserve Parameter	- - -	16bits/INT	0	0	65635	- - -
P1041	4x9041	Reserve Parameter	- - -	16bits/INT	0	0	65635	
P1042	4x9042	Reversal Fault Time	- - -	16bits/INT	0	0	65000	s
P1043	4x9043	PCP: Brake Pressure	- - -	16bits/INT	0	0	100	%
P1044	4x9044	PCP Status	Bit 0 = Release FH Test Bit 1 = In flow stabilization Bit 2 = In Reversal stage 01 Bit 3 = In Reversal stage 02 Bit 4 = Reversal End Bit 5 = FH Test End Bit 6 = PCP Enable Bit 7 = Reversal Fault Bit 8 = Hydraulic brake fault Bit 9 = Not emergency Bit 10 = Power supply fault Bit 11 = FWD/REV Bit 12 =Flow Stabilization End Bit 13 = In Demag. Flux Bits 14 and 15 = Reserved	16bits/INT	0	0	65635	- - -
P1045	4x9045	Stable Speed	- - -	16bits/INT	RO	0	8191	13 bits
P1046	4x9046	ALC11 Status	1 = In Rocking Start	16bits/INT	0	0	1	- - -

Parameter	Address	Description	Status	Size	Default	Min.	Max.	Unit
P1047	4x9047	ALC11 Status	0 = No identification (no text – blank) 1 = Local 2 = Remote 3 = Manual 4 = Automatic 5 = Timed 6 = Pump Off 7 = Pump Down 8 = Test 9 = Simulation 10 = By Pass	16bits/INT	0	0	65635	- - -
P1048	4x9048	Reserve Parameter	- - -	16bits/INT	0	0	65635	- - -
P1049	4x9049	Reserve Parameter	- - -	16bits/INT	0	0	65635	- - -
P1050	4x9050	Reserve Parameter	- - -	16bits/INT	0	0	65635	- - -
P1051	4x9051	Reserve Parameter	- - -	16bits/INT	0	0	65635	- - -
P1052	4x9052	Reserve Parameter	- - -	16bits/INT	0	0	65635	- - -
P1053	4x9053	Reserve Parameter	- - -	16bits/INT	0	0	65635	- - -
P1054	4x9054	Reserve Parameter	- - -	16bits/INT	0	0	65635	- - -
P1055	4x9055	Reserve Parameter	- - -	16bits/INT	0	0	65635	- - -
P1056	4x9056	Reserve Parameter	- - -	16bits/INT	0	0	65635	- - -
P1057	4x9057	Reserve Parameter	- - -	16bits/INT	0	0	65635	- - -
P1058	4x9058	Reserve Parameter	- - -	16bits/INT	0	0	65635	- - -
P1059	4x9059	RP_PCP_ESP Version	- - -	16bits/INT	1.08	0	327.67	- - -

TABLE OF FAULTS AND ALARMS

Fault / Alarm	Description	Possible Causes
Inverter Communication Fault	ALC11 timeout	ALC11 board incorrectly fitted to the CFW11 Defective ALC11 board Defective CFW11 control board
F021 Undervoltage Fault on the DC Bus	Undervoltage fault in the intermediate circuit.	Panel input circuit failure Input DI 5 of the inverter without power
A046 High Motor Load	Motor overload alarm. Note: Can be disabled by setting P0348 = 0 or 2.	Setting of P0156, P0157 and P0158 low for the motor used. Motor shaft load high.
F072 Motor Overload	Motor overload failure. Note: It can be disabled by setting P0348 = 0 or 3.	Setting of P0156, P0157 and P0158 too low for the motor. Motor shaft load is too high.
A090 External Alarm	External alarm via DI. Note: It is necessary to program DI for "without external alarm".	Wiring at input DI6 open (programmed for “without Ext. Alarm”).
F091 External Fault	External fault via DI. Note: It is necessary to program DI for "without external fault".	Wiring at input DI6 open (programmed for “without Ext. Fault”).
A753 Reversal Pump Stage 2	Start of the second stage of controlled stop, PID active to release stop.	Second stage of the controlled stop.
A754 Motor Rated Flux Stabilization	Function before starting the motor, it keeps the value at low speed for internal calculations of the inverter in order to optimize the controlled stop.	Flux stabilization active.
A755 Disabled by Power Failure	Inverter input DI5 activated, and the controller initiated the controlled stop.	Input DI5 of the inverter activated
A756 Disabled by Emergency Actuated	Emergency button actuated, and the controller initiated the controlled stop.	Emergency button actuated
A757 Disabled by Leakage	Inverter input DI3 actuated, and the controller initiated the controlled stop.	Inverter input DI3 without power ALC11 input DI4 actuated
A760 Reversal Pump Stage 1	Beginning of the first controlled stop stage.	First stage of pump reversal at controlled stop
F781 Controlled Stop Fault	Inverter failed to reach specified torque values.	Analyze reversal parameters, motor torque too high, auto-adjust again Torque value P1032 is too low Time value to perform controlled stop P1042 too low.
F783 Hydraulic Brake Test Fault	Failure to perform the hydraulic brake test	Minimum pressure value P1028 too high. Inverter analog input AI2 wiring broken
F793 Leakage Detected	Leakage condition failure	Inverter input DI3 deactivated DI03 = 1 without leakage. DI03 = 0 with Leak. Wiring at open DI3 input
F794 Emergency Actuated	Emergency actuated	Inverter input DI4 deactivated DI04 = 1 without emergency. DI04 = 0 with emergency. Wiring at open DI4 input

Fault / Alarm	Description	Possible Causes
F795 Power Fault	SRW detects power supply failure and disables input contactor	Wiring at input DI5 is open Problems with the power supply of the systems.
F950: Hardware Fault in the ALC11 Controller	Indicates failure in hardware initialization of the ALC11 board	Check that the board is correctly seated and with the fixing screws. Incorrect connections or voltage surges may have damaged board components required replacement.
F951: Internal Fault in the ALC11 Ladder Application	Indicates internal failure of the control method ladder application	Problems in changing the method. Problems when updating the ladder, it is necessary to update the board again.
A952: SDCARD not Detected	Indicates the absence of the SDCARD	SDCARD incorrectly inserted, it is necessary to remove and insert again with the board de-energized.
A953: Error Accessing SDCARD	Indicates that ALC11 is unable to access the SDCARD	Corrupt SDCARD. SDCARD badly inserted into the board. It is necessary to update the SDCARD folders and insert again.
A954: ALC11 Battery Error	Indicates that the battery of the ALC11 card is low or no charge	Indicates that the card's battery is empty. Latch to prevent the battery from running out has not been removed after receiving the panel.
A955: COM1 Serial Communication Fault	Indicates communication error on serial port COM1	It is necessary to check the settings of the COM1 port and the slaves or network master.
A956: COM2 Serial Communication Fault	Indicates communication error on serial port COM2	It is necessary to check the settings of the COM2 port and the slaves or network master.
A957: COM3 Serial Communication Fault	Indicates communication error on serial port COM3	It is necessary to check the settings of the COM3 port and the slaves or network master.
A958: External Alarm	This alarm signals an external alarm is activated.	Check signal from digital input DI6 of CFW11
A962 Stop in Local by Remote Command	Controlled in local mode, it receives a stop command from the supervisory.	Stop command sent via supervisory with panel in local mode
F963 Pump Rocking Start Fault	Failure pump unlocking.	Torque limit value too low Pump effectively locked.
A964 Torque Limit Alarm on Rod has been Reached	Rod torque is too high. Check mechanical system settings	Check the torque limit on the rod. Check the mechanical settings of the pump.
F965 Maximum Torque Limit Fault on Rod has been Reached	Maximum torque failure reached on the rod.	Maximum torque limit value too low.
A966 Motor Torque Alarm Reached	Maximum motor torque reached	Torque value in the motor calculated by the controller greater than the defined limit, check mechanical settings and programmed value in the motor torque.
F967 Minimum Motor Torque Fault	Minimum motor torque reached	Torque value calculated by the inverter less than the defined limit (D0034).
F968 Leakage Condition Fault	Leakage condition via DI.	Input DI2 of the inverter without power Input I04 of ALC11 actuated

Fault / Alarm	Description	Possible Causes
F969 Very Low Pressure Fault on the Production Line	Very low pressure condition on the production line.	ALC11 input I02 without power
F970 Very High Pressure on the Production Line Fault	Very high pressure on the production line	Pressure value (inverter analog input AI2) greater than the HH limit of the production line (D0009)
F971 Very Low Pressure on the Production Line Fault	Very low pressure on the production line	Pressure value (inverter analog input AI2) less than the production line limit LL (D0014)
A972 Low Pressure Alarm on the Production Line	Low pressure on the production line	Pressure value (inverter analog input AI2) less than the limit L of the production line (D0013)
F973 Minimal Downhole Pressure Fault	Very low downhole pressure reached	Pressure value (analog input E1 of the controller) less than the pressure limit (D0015).
F974 Maximum Downhole Pressure Fault	Very high downhole pressure reached	Pressure value (analog input E1 of the controller) greater than the pressure limit (D0016).
F975 Maximum Downhole Temperature Fault	Maximum downhole temperature reached	Temperature value (analog input E2 of the controller) greater than the temperature limit (D0017).
A976 High Pressure on the Production Line	High pressure on the production line	Pressure value (analog input AI2 of the inverter) greater than the limit H of the production line (D0026)
F977 Motor Overtemperature Fault	Motor overtemperature	Motor temperature value higher than the temperature limit (D0030)
A978 Motor Overtemperature Alarm	High motor temperature	Motor temperature value higher than the temperature limit (D0031)
F979 Very High Torque on the Rod Fault	Very high torque on the rod fault	Calculated torque value greater than the torque limit on the rod (D0035). Pulley values and inconsistent reducer ratio generating an error in the torque calculation.
A980 High Torque on the Rod Alarm	High torque on the rod alarm	Calculated torque value greater than the torque limit on the rod (D0036). Pulley values and inconsistent reducer ratio generating an error in the torque calculation.
F981 Very Low Torque on the Rod Fault	Very low torque on the rod fault	Calculated torque value less than the torque limit on the rod (D0038). Pulley values and inconsistent reducer ratio generating an error in the torque calculation.
A982 Low Torque on the Rod Alarm	Low torque on the rod alarm	Calculated torque value less than the torque limit on the rod (D0037). Pulley values and inconsistent reducer ratio generating an error in the torque calculation.
A985 Leakage Alarm	Alert of possible leakage	Input I04 of the ALC11 deactivated. I04 = 1 without leakage. I04 = 0 with leakage. Wiring at input I04 open.
A940: Analog channel EAX1 very high	This alarm signals that the EAX1 signal is above the programmed level	Value really very high, check if the levels are correct.
A941: Analog channel EAX1 high	This alarm signals that the EAX1 signal is above the programmed level	Value really high, check if the levels are correct.
A942: Analog channel EAX1 low	This alarm signals that the EAX1 signal is below the programmed level	Value really low, check if the levels are correct.

A943: Analog channel EAX1 very low	This alarm signals that the EAX1 signal is below the programmed level	Value really very low, check if the levels are correct.

1 SAFETY INSTRUCTIONS

This manual contains the required information for the correct use of the ALC11 progressive cavity pumping method – PCP.

This manual must be used by people with proper technical training or qualification to operate this kind of equipment.

1.1 SAFETY NOTICES IN THE MANUAL

The following safety warnings are used in this manual:

DANGER!
The procedures recommended in this warning aim at protecting the user against death, serious injuries and considerable material damages.

ATTENTION!
The procedures recommended in this warning aim at preventing material damages.

NOTE!
The item contains important points to be observed.

2 GENERAL INFORMATIONS

2.1 ABOUT THE MANUAL

This manual provides the required description to configure the ALC11 module for the progressive cavity pump method with the CFW11 Artificial Lift Drive (ALD11) frequency inverter. This manual must be used together with the CFW11 user manual and the ALC11Tools manual.

2.2 TERMINOLOGY AND DEFINITIONS

2.2.1 Abbreviations and Definitions Used

ALD11 Artificial Lift Drive, CFW 11 frequency inverter with artificial lift firmware + ALC11 controller (CFW11...HALSTZ)
ALC11 Pumping controller (Artificial Lift Controller)
ALC11-PCP ALC11 with progressive cavity pump firmware
ALC11Tools ALC11 Configuration software
API Oil density degree
APPP Leakage detection sensor
BSW Indicates the water content in the oil
CPM Cycles per minute
CRC Cycling Redundancy Check
EU Engineering unit
PLC Programmable Logic Controller
PU Pump unit
RAM Random access memory
PCP Progressive cavity pump artificial lifting method
USB Universal Serial Bus
WLP Ladder Language Programming Software

2.2.2 Numerical Representation

Decimal numbers are represented by means of digits without suffix. Hexadecimal numbers are represented with the letter “h” after the number.

3 INTRODUCTIONS TO PROGRESSIVE CAVITY PUMPING IN THE ALC11-PCP

This manual describes the oil lift control system of oil wells operated by the PCP (Progressive Cavity Pumping) lift method. In general terms, it mainly aims at describing the ALC11-PCP controller database, addressing the structure of its memory map, as well as the functional meaning of the configuration parameters and the process data provided for supervision.

3.1 THE PROGRESSIVE CAVITY PUMPING

Progressive cavity pumping is an artificial lift method in which energy is transferred to the fluid by means of a progressive cavity pump. In general terms, a progressive cavity pump consists of a helical rotor, a stator composed of an internally elastomer-coated steel tube, and a motor coupled to the wellhead.

When the rotor is inserted into the stator, this stator and rotor unit form a series of cavities isolated from each other by interference lines. With the stator stopped, when rotor spins inside the stator, the cavities move axially from the suction to the pump elevation, causing the pumping action.

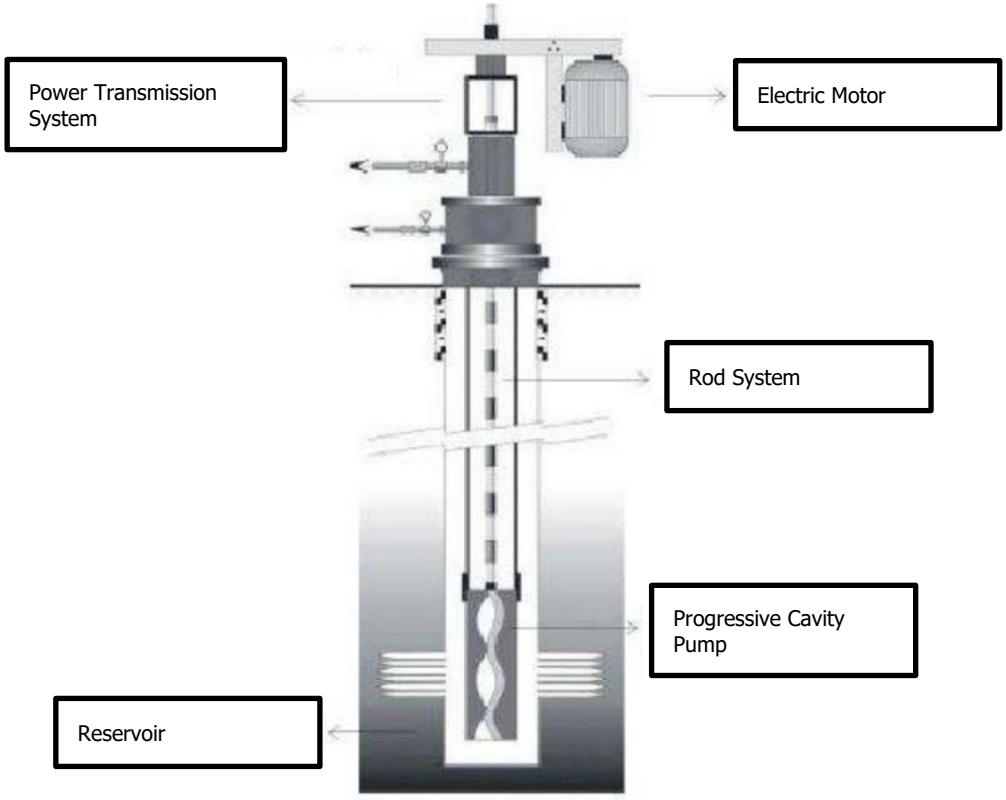

Figure 3.1 – Progressive cavity pumping well

3.2 CFW11 ARTIFICIAL LIFT DRIVE - PCP

The CFW11 Artificial Lift Drive PCP comes with factory default configurations for both digital and analog input/output functions. The control connections (analog inputs/outputs, digital inputs/outputs) must be made to the CFW11 XC1 connector.

Figure 3.2 – CFW11 Artificial Lift Drive

Below are the functions of the CFW 11 inputs and outputs in the PCP method:

Table 3.1 – Functions of CFW11 inputs and outputs

Function	Type	Order	Connector XC1		Description
Inputs	Analog	01	2	AI1 +	Hydraulic brake pressure
			3	AI1 -	
		02	5	AI2 +	Line pressure
			6	AI2 -	
	Digital		13	24 V	24V Source
		01	15	DI1	Start/Stop (*1)
		02	16	DI2	Local/Remote (*1)
		03	17	DI3	Leakage sensor (Trip)
		04	18	DI4	Emergency actuated
		05	19	DI5	Power supply fault
		06	20	DI6	External Alarm/Fault
Outputs	Analog	01	7	AO1	Motor speed
			8	AGND	
		02	9	AO2	Motor current
			10	AGND	
	Digital	01	22	COM	No fault
			23	NA1	
		02	25	COM	Run
			26	NA2	
		03	28	COM	Reserve
			29	NA3	

(*1) if R0026 = 0, DI1 and DI2 change configuration; see section 6.9.

3.2.1 ALC11 Controller

The CFW11 Artificial Lift Drive is composed of the ALC11 control board, which is inserted into the CFW11.

Figure 3.4 – *ALC11 Controller*

Below we present the functions of the ALC11 inputs and outputs in the PCP method:

Table 3.2 - *Functions of ALC11 inputs and outputs*

Functions	Type	Order	Connector XC30		Description
Inputs	Analog	00	6	E0	Reserve
		01	7	E1	Downhole pressure
		02	8	E2	Downhole temperature
		06	1..5	E6	Reserve
	PT 100	03	10..12	E3	Temperature of phase U
		04	13..15	E4	Temperature of phase V
		05	16..18	E5	Temperature of phase W
	Type	**Order**	**Connector XC31**		**Description**
	Digital	00	1..2	I0	Reserve
		01	3..4	I1	Reserve
		02	5	I2	Line underpressure
		03	6	I3	Line overpressure
		04	7	I4	Leakage alert
		05	8	I5	Manual/Automatic
Outputs	Digital	00	12	O0	Selected PCP
		01	13	O1	Selected automatic mode
		02	14	O2	Acoustic alarm
		03	15	O3	Started in Remote

4 OPERATION MODES

The CFW11 Artificial Lift Drive enables the operation of the pumping unit in a variety of conditions, facilitating operations such as maintenance, operation at constant speed or automatically controlled by control strategies. The following operating modes are available:

■ LOCAL Operation: In this mode, the CFW11 Artificial Lift Drive operates in the LOCAL mode, and the ALC11 controller does not control the pumping unit speed. In this scenario, it allows the pumping unit to start and stop, as well as to manually specify the motor RPM operating speed, either locally on the control panel or via the ALC11Tools application.

■ REMOTE Operation: In this mode, the CFW11 Lift Artificial Drive operates in the REMOTE mode, providing remote operation resources, for example by means of a communication system via radio. In this scenario, we have the following subtypes of system operation:

- Manual Remote Model: Allows remote start and stop of the pumping unit, as well as manual speed adjustment via the ALC11Tools application or remote supervision system.

- Automatic Remote Mode: the controller has a control strategy that acts on the pumping unit speed using a configurable control point of the downhole pressure as reference. This strategy controls the operating speed, acting on the speed of the pumping unit rod in order to keep the pressure level stable upon the reservoir variations.

4.1 LOCAL/REMOTE MODE SELECTION

In the CFW11 Artificial Lift Drive, the digital input used to select the local/remote mode must always be the CFW11 DI2; therefore, we must set the digital input DI2 for local / remote selection (P0264 = 9).

NOTE!
With parameter R0026 = 0, DI1 and DI2 change the configuration. Check section 6.9.

With the digital input properly programmed, we can select the local / remote mode. The selection between the “local” and “remote” modes can be performed via a “local / remote” selector button or switch installed on the control panel door. To select between the switch or button modes we have the following configuration:

Table 4.1 – Description of local / remote mode via selection key (DIx) or pushbutton (ALC)

Modbus Address	Parameter	Status	Description
4x8220	P0220	4 = DIx	Operation as selection switch between local and remote modes: In this case, the switch position determines the controller operating mode. In this configuration, toggling between the local and remote operating modes by means of remote control is not allowed.
		15 = ALC(M)	Operation as pushbutton. In this case, each pulse generated on this button toggles between the local and remote modes. In this configuration, toggling between local and remote operating modes by means of remote control is allowed.

To select the local / remote mode on the frequency inverter when configured for the pushbutton (P0220 = 15), just send the code of the respective command:

Table 4.2 – Description of local and remote command code

Modbus Address	Parameter	Status	Description
4x0196	M0195	10	Command code for Local mode selection in the frequency inverter
		11	Command code for Remote mode selection in the frequency inverter

4.2 LOCAL MODE

With the “Local” mode selected, the pumping unit can be started/stopped by means of:

■ CFW11 digital input DI1, where:

- At the logical level “0”, stops the pumping unit motor;

- At the logical level “1”, starts the pumping unit motor.

■ Via ALD11 HMI by means of parameter P1020.

■ Via remote command for the ALC11 by means of variable M0195. In this case, the remote actuation is only allowed to stop the pump.

Table 4.3 – Local mode settings

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x9020	P1020	1 = Stops the pumping unit motor 2 = Starts the pumping unit motor	0	0	2	- - -
4x9021	P1021	Speed reference in RPM of the motor	--	-5000	5000	RPM
4x0112	M0111	Rod speed for local VSD operation (RPM on the rod)	- - -	0	5000	RPM
4x0196	M0195	23 = Stops the pumping unit	0	0	32767	- - -
4x10057	D0028	Minimum motor speed	30	20	300	Hz
4x10059	D0029	Maximum motor speed	72	20	300	Hz

Actuation of the pump speed reference in local mode can be done:

■ Via ALD11 HMI by means of parameter P1021. In this case, this parameter must be set in RPM and refers to the motor speed, and not the rod speed.

■ Via remote command by means of variable P1021. In this case, this parameter must be set in RPM and refers to the motor speed, and not the rod speed.

The speed reference value for the motor speed is limited by ALD11 via parameters P0134 (maximum speed) and P0133 (minimum speed) in motor RPM.

ATTENTION!
Parameter P1021 refers to motor speed (RPM), and not to rod speed (RPM).

4.3 REMOTE MODE

With the “Remote” mode selected, it is possible to select between the “manual” and “automatic” modes. The selection between the “manual” and “automatic” modes can be done via:

■ Selector switch or pushbutton installed on the control panel door. To select between the switch or button modes, we have the following configuration:

Table 4.4 – Command description for selecting switch or button mode

Modbus Address	Parameter	Status	Description
0x0006	R0005	1 (ON)	Operation as selection switch between the local and remote modes: In this case, the switch position determines the controller operating mode. In this configuration, toggling between Manual and Automatic operating modes by means of remote control is not allowed.
0x0006	R0005	0 (OFF)	Operation as pushbutton: In this case, each pulse generated on this button toggles between manual and automatic modes. In this configuration, toggling between Manual and Automatic operating modes by means of remote control is allowed.

■ Via remote command for ALC11 by means of the following variables:

Table 4.5 – Commands related with the operation mode

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0218	R0217	Selects the manual remote operating mode	OFF	OFF	ON	- - -
0x0219	R0218	Selects the automatic remote operating mode	OFF	OFF	ON	- - -

4.3.1 Manual Remote Mode

In manual remote mode the pump motor can be started/stopped by means of:

Table 4.6 – Description of the manual remote mode command

Modbus Address	Parameter	Status	Description
4x0196	M0195	52	Command to start the pumping unit
		53	Command to stop the pumping unit

To start/stop the pumping unit, just send the desired code to this respective variable M0195. When processing the command, the controller resets the variable.

Actuation of the pumping unit speed reference in remote mode can be done via:

■ Remote command for the ALC11 by means of variable M0110. This variable must be set in RPM and refers to the rod speed. In this case, the rod rotational speed is limited by parameters D0018 (minimum rod speed) and D0019 (maximum rod speed).

Table 4.7 – Configuration parameters related with actuation in manual remote mode

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x0111	M0110	Speed reference	- - -	0	5000	RPM
4x10039	D0019	Maximum RPM value of the pumping unit	1500.0	1.0	5000.0	RPM
4x10037	D0018	Minimum RPM value of the pumping unit	50.0	1.0	5000.0	RPM
4x10057	D0028	Minimum motor speed	30	20	300	Hz
4x10059	D0029	Maximum motor speed	72	20	300	Hz

4.3.2 Automatic Remote Mode

In the automatic remote mode, the pump motor can be started/stopped as in the manual remote mode, and the current reference speed of the system is kept.

Operation in automatic mode differs from manual in the handling of some system functionalities. In this case, the following functionalities are only available in the automatic mode:

■ Automatic return after the very low pressure condition ends (R0002): When this option is enabled, one of the conditions to allow the pump to be restarted after the very low pressure condition ends is that the system be in automatic mode.

■ Automatic return after the very high pressure condition of the production line ends (R0007): When this option is enabled, one of the conditions to allow the pump to be restarted after the very high pressure condition ends is that the system be in automatic mode.

■ If duty time operation is enabled, when the programmed starting time is reached, one of the conditions for starting the pump is that the system be in automatic mode.

■ If locking time is enabled, it is only handled if the system is in automatic mode.

4.3.3 Automatic Control Strategy

The ALD11-PCP allows the user to configure the automatic control of the pump, acting on the pump speed to search for the defined setpoint, which is at downhole pressure.

In remote mode, the controller allows to select two ways to control the downhole pressure of the pump acting on the pump speed, it is possible to choose by parameter M0020, being:

■ M0020, in 1 selects the PID mode it is possible that the user chooses the proportional gain, integral and derivative values.

■ M0020, in 10 selects the step control mode, it is possible to configure the time interval, the increment, and the hysteresis.

In Step Control mode, the controller compares the programmed setpoint value with the sensor read value, if the percentage difference between the setpoint and the read value is less than the value programmed in the hysteresis, the controller does not perform any action at the moment. that the percentage difference is less than hysteresis the controller will act on the pump speed based on the type of actuation.

The user can choose between direct or reverse mode. By default, the control is prepared for directly proportional, that is, if the setpoint is greater than the value read, the control will increase the pump speed. If the setpoint is lower than the value read, the control will decrease the pump speed, if the user wishes, it is possible to set it to inversely proportional.

The user must configure the following parameters:

Table 4.8 – Automatic remote mode functions

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0122	R0121	STS VSD: ON = Switch OFF = Pushbutton (local / remote selection)	OFF	OFF	ON	- - -
0x0216	R0215	CMD: Reverses manual / automatic operating mode (T50 panel)	OFF	OFF	ON	- - -
4x0021	M0020	Control Strategy 0 = None 1 = PID 10 = Step Control	0	0	10	- - -
0x0024	R0023	OFF = Step Control inverse, ON = Step Control direct	ON	OFF	ON	- - -
4x0022	M0021	Step interval (time between increments)	5	0	200	s
4x10015	D0007	Control setpoint (Step Control or PID)	(D15+D16)	D15	D16	psi
4x10087	D0043	Hysteresis (range% where control does not act)	5.0	0.0	30.0	%
4x10089	D0044	Step size (size of the stem RPM increment / decrement)	1.0	0.0	20.0	Rod RPM
4x10031	D0015	Minimum alarm limit for downhole pressure	1.0	1.0	10000.0	psi
4x10033	D0016	Maximum alarm limit for downhole pressure	1000.0	1.0	10000.0	psi
4x10043	D0021	PID proportional gain	0.1	0.0	1000.0	- - -
4x10045	D0022	PID integral term	5.0	0.001	50000.0	- - -
4x10047	D0023	PID derivative term	0.0	0.0	1000.0	- - -

Follows equation for calculating engine speed (rpm) as a function of rod speed (rpm):

Motor speed (rpm) = Rod speed (rpm) * Mechanical ratio

Follows equation for calculating the mechanical ratio:

$$\text{Mechanical ratio} = \frac{\text{(D0005 = Pump pulley diameter)} * \text{(D0024 = Head reduction)}}{\text{(D0004 = Motor pulley diameter)}}$$

Table 4.9 – Mechanical relations

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x10011	D0005	Pump pulley diameter	240.0	50.0	5000.0	mm
4x10009	D0004	Motor pulley diameter	60.0	20.0	500.0	mm
4x10049	D0024	Head reduction	4	1	50	- - -

5 SYSTEM START AND STOP

The ALD11 for PCP wells offers four functions, three directly related to the pump start and one related to the pump stop:

- Pump start:
  - Hydraulic brake test;
  - Pump rocking start;
  - Motor flux stabilization.
- Pump stop:
  - Stop control.

The figure below illustrates the flow chart of the system initial startup.

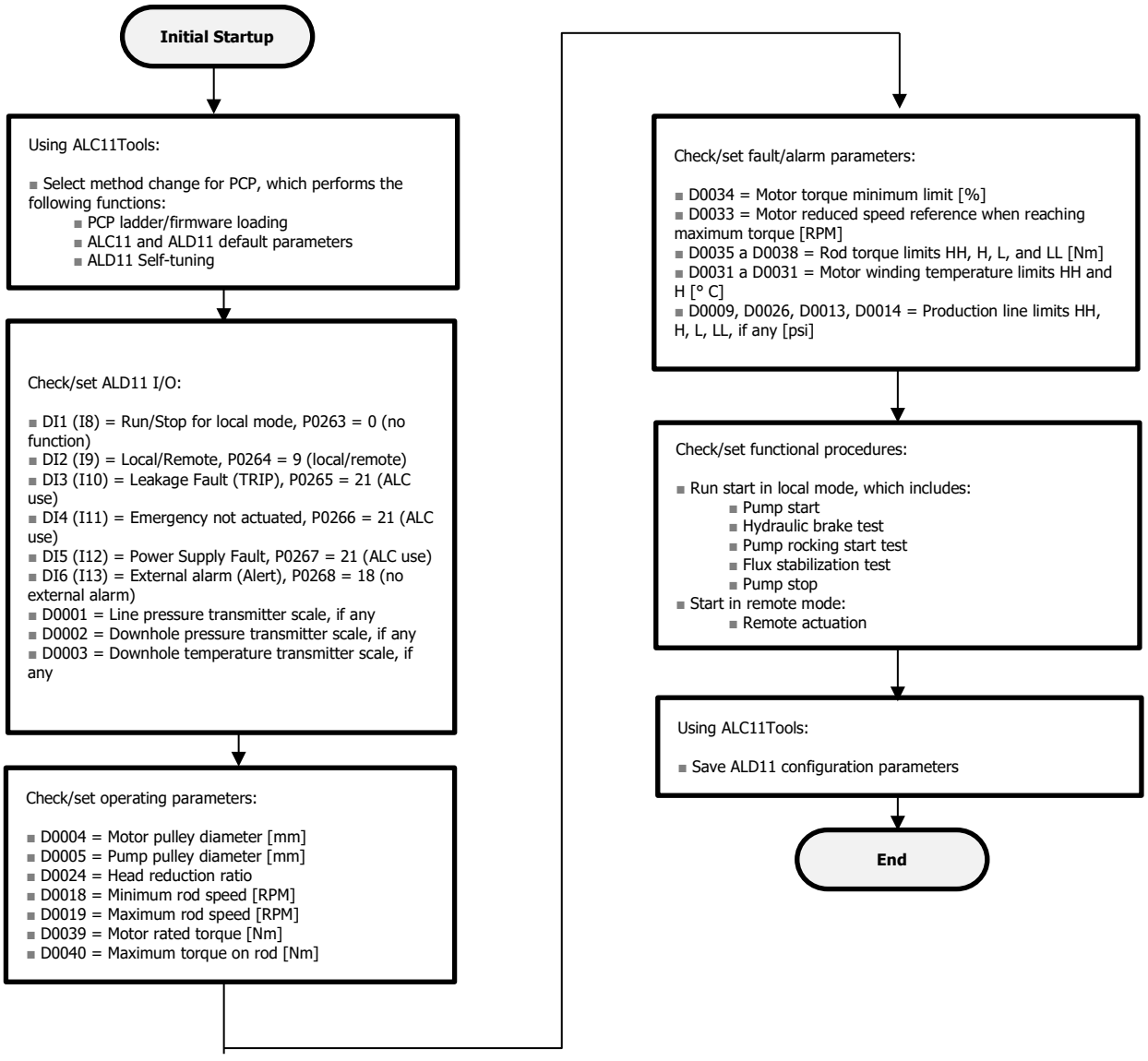

Figure 5.1 – Initial startup procedure

5.1 PUMP START SEQUENCE

The pump start follows the sequence below:

1. Acoustic signal before the pump starts.
2. Start the pump motor.
3. The hydraulic brake test is executed if enabled.
4. The rocking start test is executed enabled.
5. The pump operating speed reference is programmed.
6. The motor flux stabilization is executed.

The figure below illustrates the flow chart of the pump start:

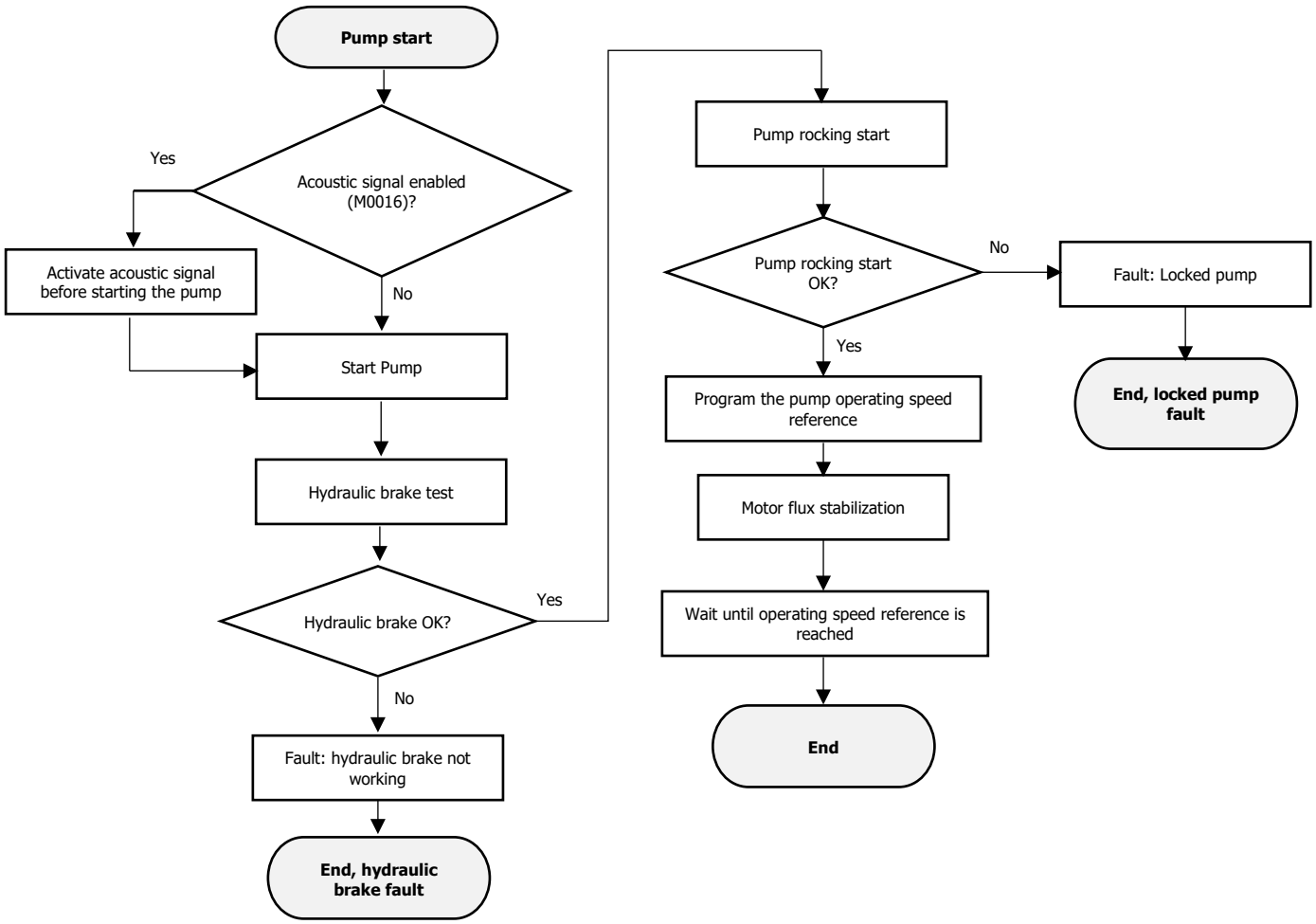

Figure 5.2 – Pump start procedure

The pump start has the following configuration parameters:

Table 5.1 – Other configuration parameters

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x0009	M0008	Delay to start the pump after energizing or resetting the controller (*1)	RTC Seconds (0..59)	0	60	s
4x0017	M0016	Acoustic signal time before starting the motor (*2)	0	0	60	s

NOTE!
(*1) The seconds of the controller calendar clock are used as default value for this parameter in order to distribute the start of each well at different moments under a power drop condition in a field with several wells.
(*2) In case the well is equipped with some type of horn, it always emits a warning acoustic signal to the field operators before starting the pump.

5.1.1 Hydraulic Brake Test

The hydraulic brake test is enabled via parameter P1025, where:

- 0 = Disables the hydraulic brake test.
- 1 = Enables the hydraulic brake test.

When enabled, the motor is driven to spin counterclockwise at a speed set in P1026 for a time set in P1027. In this process, it is checked if the hydraulic fluid pressure reaches a minimum value defined by the user in parameter P1028 to ensure that the brake is in perfect working condition.

NOTE!
The hydraulic brake test can only be used if the brake pressure sensor is installed on the pump.

The figure below illustrates the flow chart of the hydraulic brake test.

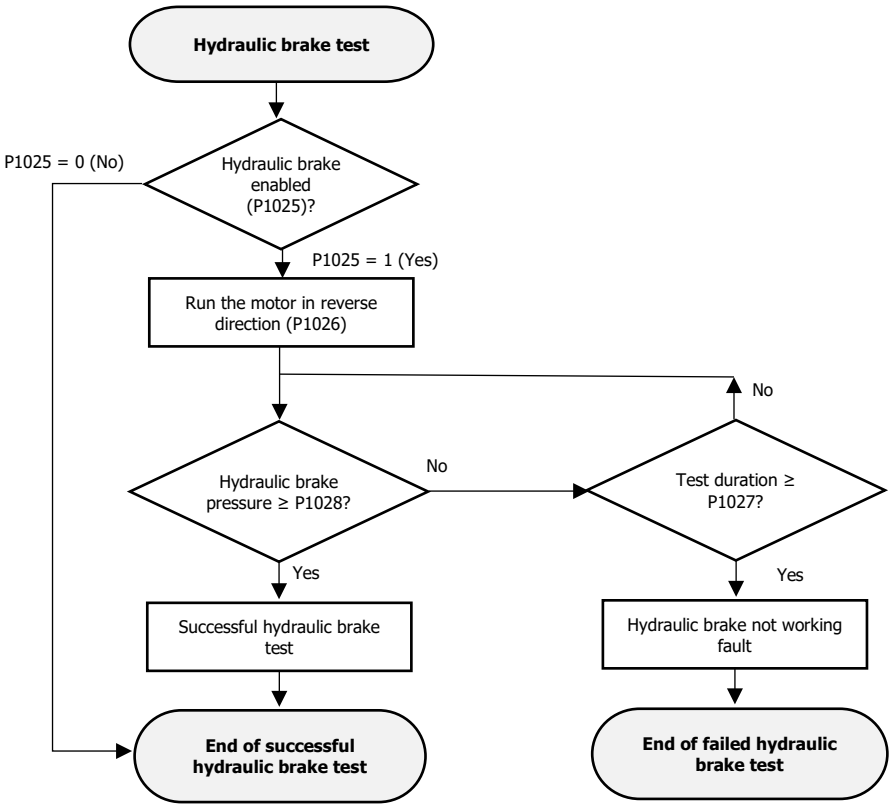

Figure 5.3 – Hydraulic brake test procedure

The tables below list the available setting and monitoring parameters associated with the hydraulic brake test.

Table 5.2 – Setting parameters related to the hydraulic brake test

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x9025	P1025	Enables hydraulic brake test	0	0	1	0
4x9026	P1026	Brake reverse speed reference	100	10	100	RPM
4x9027	P1027	Test duration	10	1	400	s
4x9028	P1028	Hydraulic brake minimum pressure	40	0	100	%

Table 5.3 – Supervision parameters associated with hydraulic brake test

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x9043	P1043	Hydraulic brake current pressure	- - -	0	100	%

5.1.2 Pump Rocking Start Function

The pump rocking start test must be enabled in parameter R0013, where:

- 0 = Disables the pump rocking start test.
- 1 = Enables the pump rocking start test.

When enabled, this function allows to start the motor monitoring the initial torque. When it is above a value programmed in D0032, the frequency inverter reverses the motor to try to release the system, and then start the pump. This process may happen up to the limit of times set in M0042 in an attempt to release and start the motor.

At the end of this function, if the system has been released, the motor receives the pump operating speed reference and goes into normal operation. In case the rocking start test reaches the maximum number of attempts without releasing the motor, the fault “Locked Pump” is generated.

The figure below illustrates the flow chart of the pump rocking start:

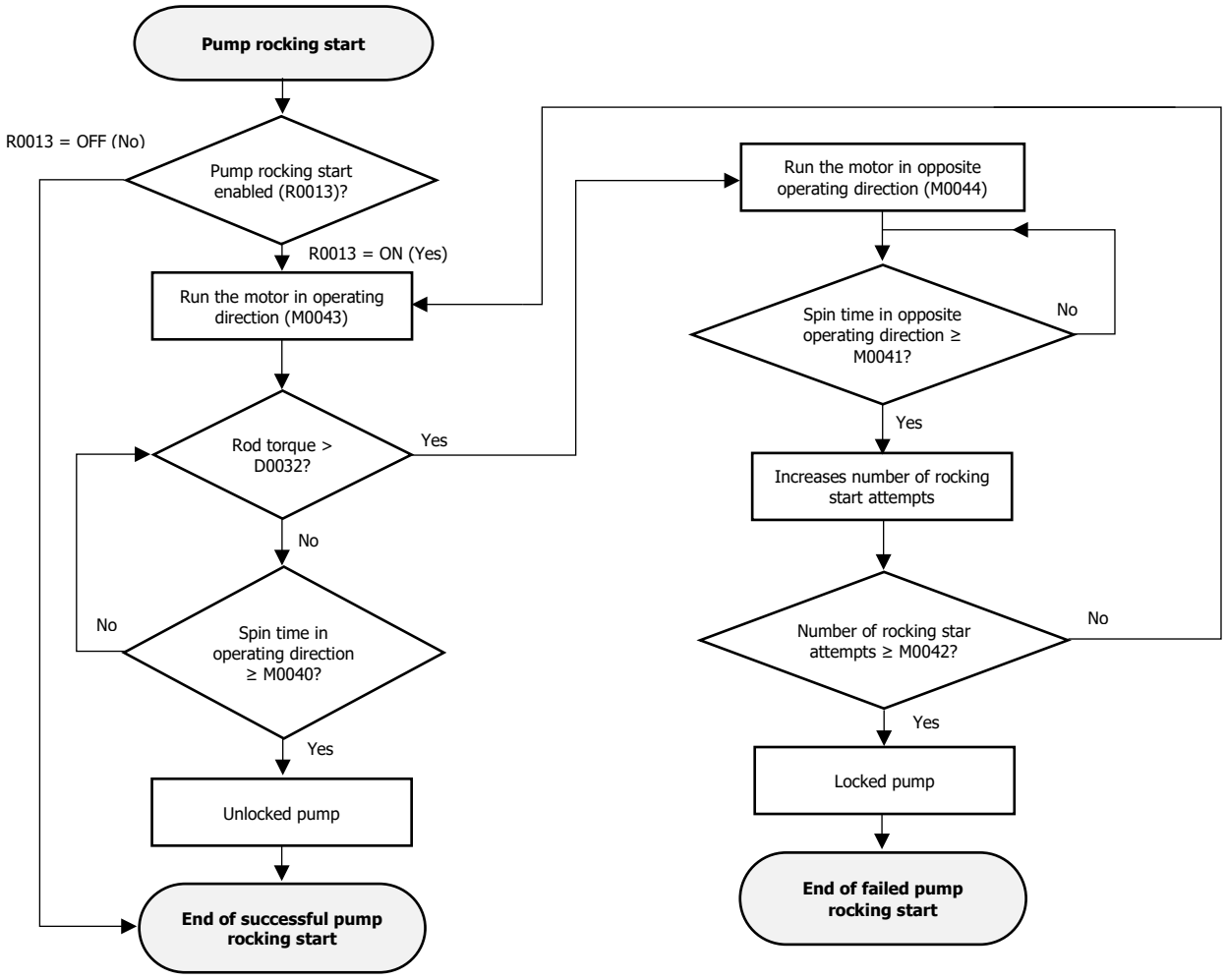

Figure 5.4 – Pump rocking start procedure

The parameters associated with the pump rocking start are listed in the table below:

Table 5.4 – Configuration for pump rocking start

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0X0014	R0013	Enables the pump rocking start	OFF	OFF	ON	- - -
0x0128	R0127	ON = In test procedure for pump rocking start	OFF	OFF	ON	- - -
0x0129	R0128	ON = Pump rocking start test carried out with SUCCESS	OFF	OFF	ON	- - -
4X0041	M0040	Spinning time in the operation direction	5	1	60	s
4X0044	M0043	Motor speed in the operation direction	10	10	300	RPM
4X0042	M0041	Spinning time in the opposite direction of the operation	5	1	60	s
4X0045	M0044	Motor speed in the opposite direction of the operation	10	10	300	RPM
4X0043	M0042	Number of cycles of the pump rocking start	5	1	10	- - -
4x10065	D0032	Maximum torque on the rod during start	0.0	0.0	100.0	%

5.1.3 Flux Stabilization Function

During the acceleration, the frequency inverter maintains the motor at the speed set in P1024 for the time set in P1035, so that the frequency inverter establishes the best parameter group to maintain the motor rated flux when running at low speeds (< 5% of the motor rated frequency).

The figure below illustrates the flow chart of the flux stabilization:

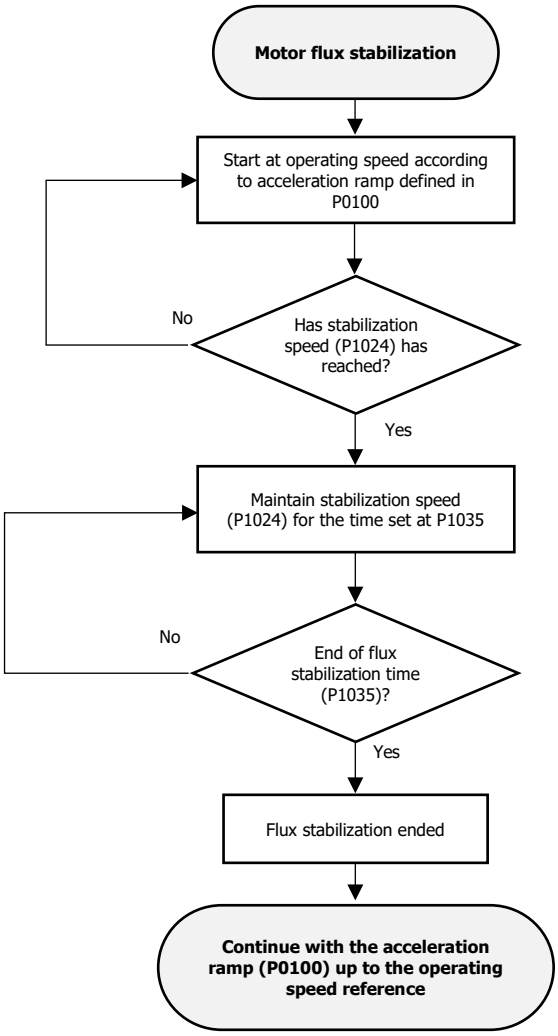

Figure 5.5 – Flux stabilization procedure

The parameters associated with the flow stabilization are listed in the table below:

Table 5.5 – Configuration for the flux stabilization

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x9024	P1024	Speed reference for stabilization	45	25	90	RPM
4x9035	P1035	Flux stabilization time	10.00	0.00	650.00	s

5.2 PUMP STOP

The pump stop control enables the rod distortion and the fluid potential energy relief to be done in controlled way when executing a stop command in a progressive cavity pump (PCP).

The function inverts the pump speed, so that the power accumulated in the system (rod + fluid) will be extinguished in the losses of the inverter + motor + gearbox + PCP pump set until the resident value is small enough for the pump to be switched off without creating accident risks.

The figure below illustrates the flow chart of the pump stop:

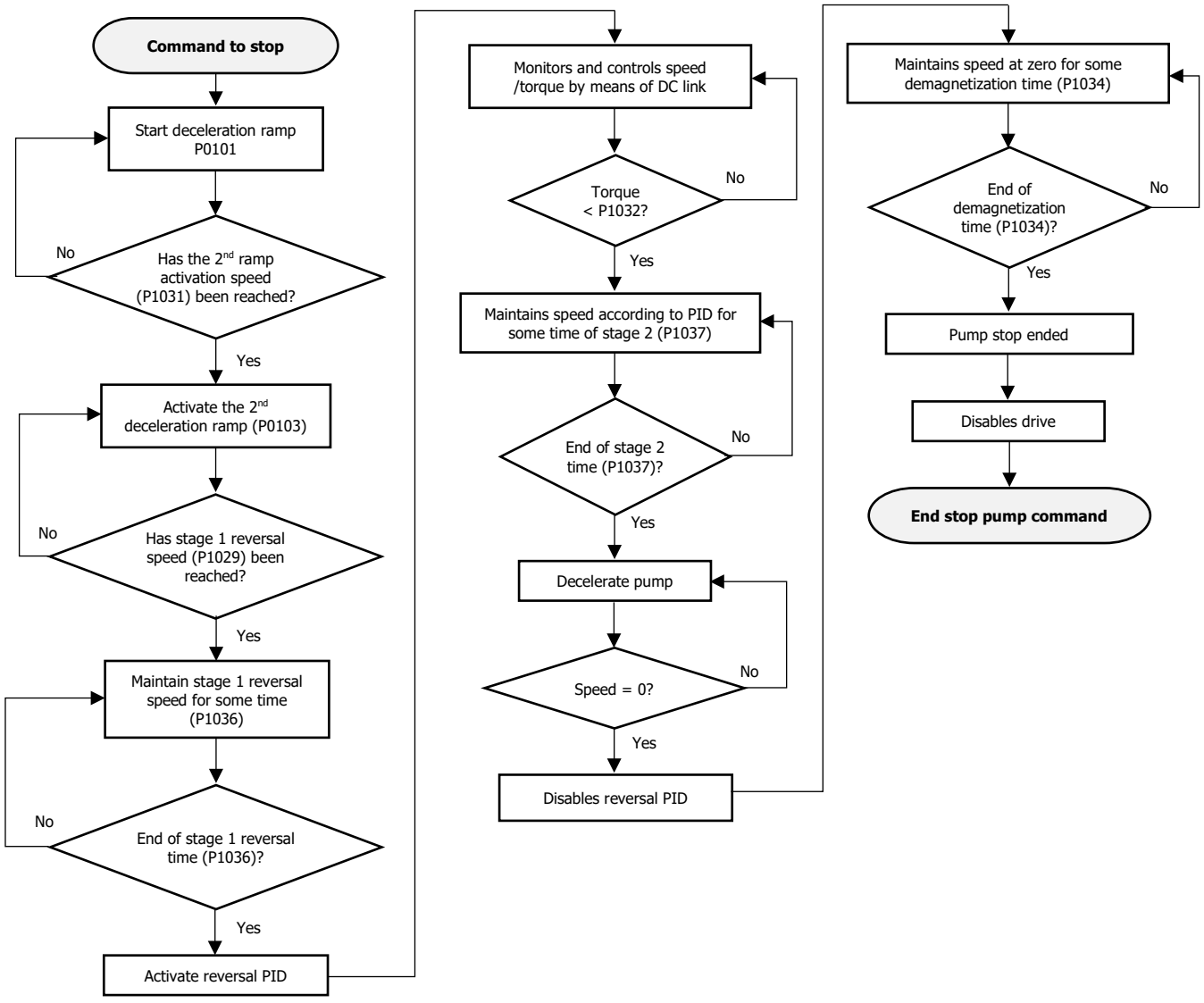

Figure 5.6 – Pump stop procedure

The parameters associated with the pump stop are listed in the table below:

Table 5.6 – Configuration for the pump stop control

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4X9029	P1029	Speed reference for stage 1 reversal	70	70	300	RPM
4X9030	P1030	Speed reference for stage 2 reversal	300	70	300	RPM
4X9031	P1031	Activation speed of the 2nd ramp	90	90	200	RPM
4X9032	P1032	End torque of stage 2 reversal	50	0.0	100.0	%
4X9034	P1034	Motor demagnetization time	0	0.00	650.00	s
4X9036	P1036	End time of stage 1 reversal	1000	0.00	650.00	s
4X9037	P1037	End time of stage 2 reversal	1000	0.00	650.00	s
4X9038	P1038	Reversal PID proportional gain	100	0	32	- - -
4X9039	P1039	Reversal PID integral gain	29	0	32	- - -
4X9042	P1042	Reversal fault time	200	0	65000	s
4X8100	P0100	Acceleration time 1	300	0	999	s
4X8101	P0101	Deceleration time 1	100	0	999	s
4X8102	P0102	Acceleration time 2	50	0	999	s
4X8103	P0103	Deceleration time 1	50	0	999	s
4x9035	P1035	Flux stabilization time	10.00	0.00	650.00	s

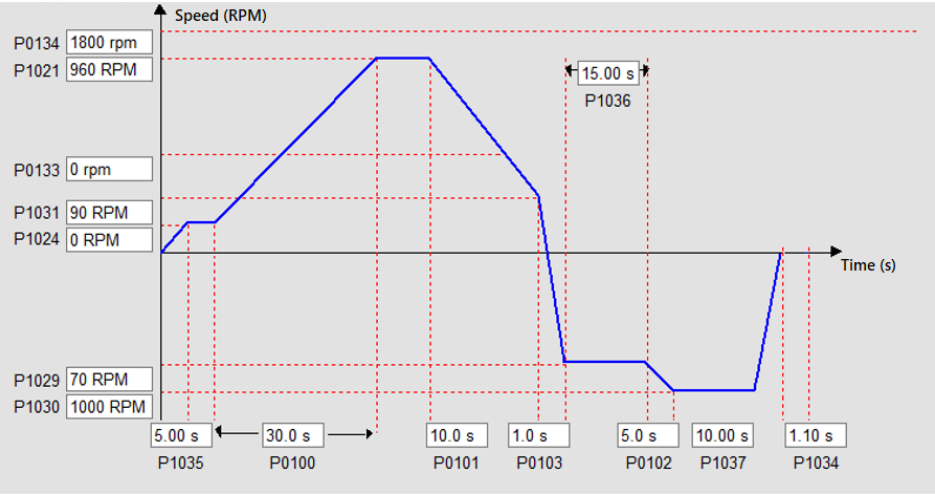

Figure 5.7 – PCP controlled stop chart

6 OPERATING FUNCTIONALITES

6.1 MONITORING OF THE LINE PRESSURE

6.1.1 Monitoring of the Production Line Low Pressure

The ALC11-PCP controller can monitor the production line high pressure. This monitoring can be performed by reading an analog signal linked to the line pressure and/or a digital signal linked to a pressure switch related to an underpressure condition of the production line. The parameters associated with this monitoring are presented in the tables below.

Table 6.1 – Configuration for monitoring the production line low pressure

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0021	R0020	ON = Enables the monitoring of the production line pressure LL and L limits and/or the production line pressure switch	ON	OFF	ON	- - -

If the production line low pressure monitoring is enabled, and a pressure transmitter is used, the respective values related to the line pressure low limits must be configured, as listed in the table below.

Table 6.2 – Configuration for monitoring the production line low pressure

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0003	R0002	ON = Enables the return to operation after a very low pressure fault (LL) ends	ON	OFF	ON	- - -
4x0032	M0031	Time to confirm pressure condition LL and L	30	1	300	s
4x0412	M0411	Line pressure value	RO	0	32767	psi
4x10027	D0013	Production line low pressure limit (L). Triggers possible production line leakage alert.	0	0.0	10000.0	psi
4x10029	D0014	Production line very low pressure limit (LL) Signals production line leakage fault	0	0.0	10000.0	psi

■ When R0002 = ON: With the system in the automatic mode, and if there is no locking or fault condition that prevents the pump from starting, after the very low pressure (LL) condition is over, it restarts the pump motor without the user having to send a command to start the pump.

■ When R0002 = OFF: After the leakage condition ends, it does not restart the pump; the user must send a very low pressure (LL) condition recognition command and then another command to start the pump.

Table 6.3 – Commands related to the line pressure

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0X0209	R0208	Command for recognition of production line very low pressure (leakage) alarm	- - -	OFF	ON	- - -

Fault and alarm status related to line low pressure are presented in the table below.

Table 6.4 – Fault and alarm status related to line low pressure

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0X0409	R0408	Production line low pressure (L) alarm	RO	OFF	ON	- - -
0X0410	R0409	Production line very low pressure fault (LL)	RO	OFF	ON	- - -

6.1.2 Monitoring of the Production Line High Pressure

The ALC11-PCP controller can monitor the production line high pressure. This monitoring can be done by reading an analog signal linked to the line pressure and/or a digital signal linked to a pressure switch linked to the production line overpressure condition. The parameters associated with this monitoring are presented in the tables below.

Table 6.5 – Configuration for monitoring the production line high pressure

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0022	R0021	ON = Enables the monitoring of the production line pressure HH and H limits and/or the production line pressure switch	ON	OFF	ON	- - -

Table 6.6 – Configuration for monitoring the production line high pressure

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0X0008	R0007	ON = Enables return to operation after a very high pressure fault (HH) ends	ON	OFF	ON	- - -
0X0010	D0009	Production line very high pressure limit (HH)	1000.0	0.0	10000.0	psi
4X10053	D0026	Production line high pressure limit (H)	1000.0	0.0	10000.0	psi
4X0011	M0010	Time to confirm the production line high (h) and very high pressure (HH)	30	0	320	s

■ When R0007 = ON: With the system in automatic mode, and if there is no locking or fault condition that prevents the pump from starting, after the very high pressure (HH) condition is over, it restarts the pump motor without the user having to send a command to start the pump.

■ When R0007 = OFF: After the very high pressure condition (HH) ends, it does not restart the pump; the user must send a very high pressure (HH) condition recognition command and then another command to start the pump.

NOTE!
The handling of return to operation after a very high pressure fault ends is done only in the automatic mode.

Fault and alarm status related to the line high pressure are presented in the table below.

Table 6.7 – Fault and alarm status related to the line high pressure

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0417	R0416	Production line high pressure alarm (H)	RO	OFF	ON	- - -
0x0404	R0403	Production line very high pressure fault (HH)	RO	OFF	ON	- - -

6.2 MONITORING OF THE MOTOR TORQUE

The ALC11-BCP controller has the capability to monitor the motor torque according to the following formula:

$$Motor\ torque = \text{Nominal motor torque} \times \text{Torque}(\%)$$

These parameters are listed in the table below:

Table 6.8 – Configuration for monitoring the motor torque

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0015	R0014	ON = Enables the monitoring of the motor maximum torque	ON	OFF	ON	- - -
4x0040	M0039	Operating time in torque limitation	600	0	30000	s
4x10079	D0039	Nominal motor torque	160.8	1.0	100000.0	Nm
4x10081	D0040	Maximum torque limit on the rod	50000.0	1.0	100000.0	Nm

To avoid rod breakage when the torque limit on the motor is reached, the controller decelerates the motor to keep the torque level below the programmed level, we have three possible scenarios:

1. If the torque drops, the controller accelerates again and returns to the speed reference.
2. If the torque does not decrease and the limitation time is reached, then the controller will stop the pump.
3. If the torque remains high, the controller will slow down to the minimum operating speed if the speed falls below the minimum operating speed the controller will also shut down the pump.

6.2.1 Maximum and Minimum Motor Torque Monitoring

The ALC11-PCP controller can monitor the motor maximum torque. These parameters are listed in the table below:

Table 6.9 – Configuration for monitoring the motor maximum torque

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0015	R0014	ON = Enables the monitoring of the motor maximum torque	ON	OFF	ON	- - -
4x0046	M0045	Time to wait for the 1st condition of the motor maximum torque	60	0	600	s
4x0047	M0046	Time to wait for the 2nd condition of the motor maximum torque	180	60	3000	s
4x10067	D0033	Motor reduced speed reference when reaching maximum torque	800	0	3600	RPM

The ALC11-PCP controller can monitor the motor minimum torque. These parameters are listed in the table below:

Table 6.10 – Configuration for the monitoring of the motor minimum torque

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0016	R0015	ON = Enables the monitoring of the motor minimum torque	ON	OFF	ON	- - -
4x0048	M0047	Time to confirm the motor minimum torque condition	120	0	6600	s
4x10069	D0034	Motor minimum torque limit	15.0	0.0	100.0	%

The fault status related to the motor torque are presented in the table below:

Table 6.11 – Fault status associated with motor torque

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0423	R0422	Motor maximum torque fault	RO	OFF	ON	- - -
0x0424	R0423	Motor minimum torque fault	RO	OFF	ON	- - -

6.3 MONITORING OF THE TORQUE ON THE ROD

The ALC11-PCP controller has feature to monitor the torque on the rod according to the following formula:

$$Rod\ torque = \frac{Pump\ pulley}{Motor\ pulley} \times Reduction\ ratio \times Motor\ torque \times Torque(\%)$$

The parameters are listed in the table below:

Table 6.12 – Configuration for monitoring the torque on the rod

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0019	R0018	ON = Enables the monitoring of the torque on the rod	ON	OFF	ON	- - -
4x10071	D0035	Very high torque on the rod limit (HH)	45000.0	1.0	100000.0	Nm
4x10073	D0036	High torque on the rod limit (H)	43000.0	1.0	100000.0	Nm
4x10075	D0037	Low torque on the rod limit (L)	10000.0	0.0	100000.0	Nm
4x10077	D0038	Very low torque on the rod limit (LL)	8000.0	0.0	100000.0	Nm
4x0039	M0038	Bypass time Minimum rod torque - LL alarm limit	10	0	32000	s

The information and the fault and alarm status related to the torque on the rod are presented in the table below.

Table 6.13 – Fault and alarm status related to the torque on the rod

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0019	R0018	ON = Enables the monitoring of the torque on the rod	ON	OFF	ON	- - -
0x0425	R0424	Very high torque on the rod fault (HH)	RO	OFF	ON	- - -
0x0426	R0425	High torque on the rod alarm (H)	RO	OFF	ON	- - -
0x0427	R0426	Low torque on the rod alarm (L)	RO	OFF	ON	- - -
0x0428	R0427	Very low torque on the rod fault (LL)	RO	OFF	ON	- - -
4x10265	D0132	Current torque (Nm) on the rod calculated by the ALC11-PCP controller	RO	0.0	3.4E+38	Nm

6.4 MONITORING OF THE MOTOR TEMPERATURE

The controller monitors the motor temperature related to phases R, S and T. These temperatures are monitored by means of three PT100 channels available in the ALC11-PCP module. Alarm limits for signaling are described in the table below.

Table 6.14 – Configuration for the monitoring of the motor temperature

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0018	R0017	ON = Enables the monitoring of the motor temperature	ON	OFF	ON	- - -
4x10061	D0030	Limit for very high motor temperature (HH), phases R, S and T	100.0	0	250.0	° C
4x10063	D0031	Limit for high motor temperature (H), phases R, S and T	90.0	0	250.0	° C

■ When limit H is exceeded and limit HH has not been exceeded yet:

- The pump motor does not stop.
- The “Motor high temperature" HH alarm is indicated.

■ When the HH limit is exceeded:

- The pump motor stops.
- The “Motor very high temperature" fault is indicated.

Fault and alarm status related to the motor temperature are presented in the table below.

Table 6.15 – Fault and alarm status related to the motor temperature

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0429	R0428	Motor very high temperature fault (HH)	RO	OFF	ON	- - -
0x0430	R0429	Motor high temperature alarm (H)	RO	OFF	ON	- - -

6.5 MONITORING OF THE DOWNHOLE SENSOR

When the system is equipped with some type of downhole sensor, it is possible to monitor the limits related to the respective downhole pressure and temperature variables, in this way, the limit settings are separated according to the type of sensor selected, which can be analog or via Modbus communication

Table 6.16 – Type of downhole sensor used in the well

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x00159	M0079	Type of downhole sensor used in the well	RW	0 – None	5 – Analog type 100 – Modbus type	- - -

6.5.1 Analog type Downhole Sensor

6.5.1.1 Monitoring of the Downhole Pressure

The limits for monitoring alarms related to the downhole pressure are described in the table below.

Table 6.17 – Configuration for the monitoring of the downhole pressure

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0028	R0027*	CFG: ON = Enables the handling of the downhole pressure alarms HH and LL, OFF = disable	ON	OFF	ON	- - -
4x10033	D0016	Maximum limit for downhole pressure	10000.0	1	10000.0	psi
4x10031	D0015	Minimum limit for downhole pressure	1.0	1	10000.0	psi
4x0038	M0037	Downhole pressure bypass time: HH alarm limit	10	0	32000	s
4x0413	M0412	Downhole pressure value	RO	0	32767	psi

*The command to disable the treatment of pressure alarms is only applied to the analog sensor

When the limits specified for the downhole pressure are exceeded, the system indicates a high downhole pressure or low downhole pressure alarm message, without stopping the pump though.

Fault and alarm status related to the downhole pressure are presented in the table below.

Table 6.18 – Fault and alarm status related to the downhole pressure

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0405	R0404	Minimum downhole pressure fault	RO	OFF	ON	- - -
0x0406	R0405	Maximum downhole pressure alarm	RO	OFF	ON	- - -

6.5.1.2 Monitoring of the Downhole Temperature

The limits for monitoring alarms related to the downhole temperature are described in the table below.

Table 6.19 – Configuration for the monitoring of the downhole temperature

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x0418	M0417	Downhole temperature value	RO	0	32767	° C
4x10035	D0017	Maximum limit for downhole temperature	250.0	10.0	500.0	° C

Fault and alarms statuses related to the downhole temperature are presented in the table below.

Table 6.20 – Fault and alarm status related to the downhole temperature

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0407	R0406	Maximum downhole temperature fault	RO	OFF	ON	- - -

6.5.2 Modbus type Downhole Sensor

To allow the ALC11 module to read the parameters provided by the sensor, it is necessary to configure the parameters related to Modbus communication and the measurement units related to the variables provided by the sensor.

Table 6.21 – Configuration of Modbus communication and measurement units of downhole sensor

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x0078	M0077	Downhole device address for Modbus communication	127	1	1000	- - -
4x0079	M0078	ALC11 communication port for communication	1	0	2	- - -
4x0085...4x0086	M0084 a M0085	Downhole sensor engineering unit: Downhole pressure	bar	-	-	- - -
4x0087...4x0088	M0086 a M0087	Downhole sensor engineering unit: Downhole temperature	°C	-	-	- - -
4x0089...4x0090	M0088 a M0089	Downhole sensor engineering unit: Sensor current	mA	-	-	- - -
4x0091...4x0092	M0090 a M0091	Downhole sensor engineering unit: Sensor voltage	V	-	-	- - -
4x0093...4x0094	M0092 a M0093	Downhole sensor engineering unit: Vz Vibration	g	-	-	- - -
4x0095...4x0096	M0094 a M0095	Downhole sensor engineering unit: Vx Vibration	g	-	-	- - -

Table 6.22 – Configuration of Modbus communication fault with downhole sensor

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0145	R0144	Modbus communication fault with downhole sensor	-	OFF	ON	- - -

6.5.2.1 Monitoring of Downhole Pressure

The limits for monitoring alarms related to the downhole pressure are described in the table below.

Table 6.23 – Configuration for the monitoring of the downhole pressure

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x10129	D0064	Downhole pressure low limit	2	1	10000.0	bar/psi
4x10031	D0015	Minimum limit for downhole pressure	5	1	10000.0	bar/psi
4x0145	M0072	Time to confirm LL and L limit downhole pressure	30	0	32000	s
4x10227	D0113	Downhole pressure value	RO	0	32767	psi

When the limits specified for the downhole pressure are exceeded, the system indicates a high downhole pressure or low downhole pressure alarm message, without stopping the pump though.

Fault and alarm status related to the downhole pressure are presented in the table below.

Table 6.24 – Fault and alarm status related to the downhole pressure

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0095	R0094	Downhole pressure lower limit alarm	RO	OFF	ON	- - -
0x0143	R0142	Downhole pressure L limit alarm	RO	OFF	ON	- - -
0x0405	R0404	Minimum downhole pressure fault	RO	OFF	ON	- - -

6.5.2.2 Monitoring the Downhole Temperature

The limits for monitoring alarms related to the downhole temperature are described in the table below.

Table 6.25 – Configuration for the monitoring of the downhole temperature

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x10229	D0114	Downhole temperature value	RO	0	32767	° C
4x10133	D0066	Downhole temperature high limit	80	10	500.0	° C
4x10035	D0017	Downhole temperature maximum limit	90	10	500.0	° C
4x0074	M0073	Time to confirm HH and H limit downhole temperature	30	0	120	s

Fault and alarms status related to the downhole temperature are presented in the table below.

Table 6.26 – Fault and alarm status related to the downhole temperature

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0097	R0096	Downhole temperature higher limit alarm	RO	OFF	ON	- - -
0x0144	R0143	Downhole temperature H limit alarm	RO	OFF	ON	- - -
0x0407	R0406	Maximum downhole temperature fault	RO	OFF	ON	- - -

6.5.2.3 Downhole Sensors Extra Variables

In addition to providing the pressure and background temperature, this sensor provides other variables for reading as shown in the table below.

Table 6.27 – Downhole sensors extra variables

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x10231	D0115	Sensor current valuer	RO	0	32767	[EU]
4x10233	D0116	Sensor voltage value	RO	0	500.0	[EU]
4x10235	D0117	Vz vibration valuer	RO	10	500.0	[EU]
4x10237	D0118	Vx vibration value	RO	0	120	[EU]

6.6 OPERATION TIME

If it is necessary to restrict the pump operation within a specific time interval, just enable the pump operation within such period of duty operation. When the time to start the duty operation is reached, a command to start the pump is sent, and when the time to end the duty operation is reached, the system sends a command to stop the pump. Thus, during the interval outside this duty operation time, the motor is stopped, but it can be started manually via the remote command of the supervision system.

For a typical case of use, in certain production fields, a pump operation interval may be specified for daytime only, thus stopping the pump operation at night, when the lower temperature may wax the production line.

6.6.1 Operation Time Configuration

The ALD11-PCP controller provides resources for pump operation within a duty time or 24-hour continuous duty. These parameters are listed in the table below:

Table 6.28 – Pump operation time configuration

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0002	R0001	Configuration the type of time for pump operation, where: • ON = Operation with duty time • OFF = 24-hour continuous operation	OFF	OFF	ON	- - -

If configured for duty operation, it is necessary to set the respective pump start and stop operation times, as listed in the table below:

Table 6.29 – Configuration the duty time for pump operation

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x0005	M0004	Hours of the time set to start the duty operation interval	0	0	23	h
4x0006	M0005	Minutes of the time set to start the duty operation interval	0	0	59	min
4x0007	M0006	Hours of the time set to end the duty operation interval	0	0	23	h
4x0008	M0007	Minutes of the time set to end the duty operation interval	0	0	59	min

If the start of duty time has been reached, the pump is started, and if no event occurs to force the pump to stop, it remains on until the end of duty operation is reached.

NOTE!
Duty time is handled in the automatic mode only.

The status related to the monitoring of the duty time are presented in the table below.

Table 6.30 – Status of operation in duty time

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0110	R0109	When operation in duty time is enabled, it is possible to identify if the system is operating within or out of the duty time: • ON = System operating out of the duty time • OFF = System operating within the duty time	RO	OFF	ON	- - -

6.7 LOCKING TIME FOR THE PUMP AUTOMATIC RETURN

The locking time refers to a period of time (hours) when the system, if shut down, for example by a fault, must not automatically restart after the end of the fault condition. The purpose of this locking time is to allow the user to prevent the well, once shut down by a fault like production line high pressure, from being restarted during the night when pressures on the production line become abnormally high due to their paraffinating.

Table 6.31 – Locking time enable

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0007	R0006	Locking time enabling: • ON = Disables the handling of the locking time for the pump automatic return • OFF = Enables the handling of the locking time for pump automatic return	ON	OFF	ON	- - -

If the locking time for the pump automatic return is enabled, the respective pump locking start and stop times must be set, as listed in the table below.

Table 6.32 – Locking time settings for the pump automatic return

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x0001	M0000	Hours of the time set to start the locking interval for return	0	0	23	h
4x0002	M0001	Minutes of the time set to start the locking interval for return	0	0	59	min
4x0003	M0002	Hours of the time set to end the locking interval for return	0	0	23	h
4x0004	M0003	Minutes of the time set to end the locking interval for return	0	0	59	min

If there is a fault that causes the pump to shut down, and the fault condition ends within the interval specified by this locking time, the pump is not automatically restarted, waiting for an external command to return to operation. For example, a night time locking interval can be set, when the pump should not return to operation in the event of a fault.

NOTE!
Locking time is handled in the automatic mode only.

The status related to the monitoring of the locking time are presented in the table below.

Table 6.33 – Operating status in locking time

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0111	R0110	When the operation with locking time is enabled, it is possible to identify if the system is operating within or out of the locking time: • ON = System operating within the locking time • OFF = System operating out of the locking time	RO	OFF	ON	- - -

6.8 AUTOMATIC RESTART

The ALC11 has an automatic restart of the system after a failure without a frequency inverter, it is possible to parameterize the time for distribution of the pump after the failure in minutes, the amount of restart in the time interval, the time to try the restart and the time in operation at minimum speed to reset the automatic restart count.

Table 6.34 – Configuration of the automatic restart

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x0019	M0018	Time for automatic pump restart after failure	30	0	120	min
4x0020	M0019	Number of attempts for automatic restart within a time interval	3	0	5	- - -
4x0033	M0032	Time interval to allow amount of automatic restart	12	1	24	h
4x0034	M0033	Minimum speed operation time for reset automatic restart attempts	5	0	600	min
4x0107	M0106	NVR: RST: Fault counter within the time range for automatic restart	RO	0	5	- - -

6.9 ENABLE LOCAL MODE

The controller has the option to enable or not a local mode, thus having local functions performed only in front of the panel, and a remote mode that has functional functions only via the network.

If the local mode is disabled it is possible to turn the pump off and on locally via the panel without the controller always checking whether it is in local or remote mode.

Table 6.35 – Local mode configurations

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0027	R0026	Local mode enabling: • ON = Enable local mode • OFF = Disable local mode	ON	OFF	ON	- - -

If the user chooses to disable the local mode, the controller will understand that the digital inputs 01 and 02 of the inverter have changed functions to:

Table 6.36 – Digital inputs configurations

Function	Type	Order	Connector XC1		Description
Entrada	Digital		13	24 V	24V Source
		01	15	DI1	Start
		02	16	DI2	Stop

For correct operation, we must change the parameters of the inverter according to the table:

Table 6.37– Automatic restart configuration

Modbus Address	Parameter	Description	Value
4x8220	P0220	LOC/REM Selection Source	01
4x8263	P0263	DI1 Function	21
4x8264	P0264	DI2 Function	21

6.10 UNDERVOLTAGE AUTOMATIC RESTART

The controller has automatic restart when there is an interruption in the drive power. If the restart is active the controller will restart the pump when the pump is running and there is a voltage drop identified by SRW or the native undervoltage fault CFW11.

After restarting the controller, it checks if it was in operation and if the reason for shutting down was a voltage drop, if so and the R0028 is “ON”, the controller restarts the pump.

Table 6.38 – Undervoltage automatic restart configuration

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0029	R0028	ON = Enables restart after undervoltage	OFF	OFF	ON	- - -

6.11 WELL IDENTIFICATION NAME

The ALC11-BCP controller has a well identification string using the ASCII system. 4 words for 8 characters are available according to the table below:

Table 6.39 – Well identification information

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x0081-0084	M0080 – M0083	Well identification name. No delimiter required for the end of the string [4M = 8 characters]	0	0	32767	- - -

6.12 COMMAND SAVE FLASH CONFIGURATION

The controller needs a command to save the RAM settings in the FLASH memory, for this command we have the variable type R0088, the controller processes the command and returns the variable to 0.

Table 6.40 – Command to save configuration base

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0205	R0204	Command to process and save the well configuration base in the flash	0	0	1	- - -

6.13 MONITORING OF RESERVE INPUT EAX1

There is an channel of analog input E0 available on the ALC11 for installing additional instrument to acquire values and monitor alarm limits. This analog signal is referred to here as EAX1.

Initially, the operating scale associated with the instrument connected to this analog input must be configured, as listed in the table below.

Table 6.41 – Scale configuration of the EAX1 analog instrument

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x10093	D0046	Minimum scale in engineering unit [EU] of the analog input EAX1 instrument	0.0	1.2E-38	3.4E+38	Depends on the instrument
4x10095	D0047	Maximum scale in engineering unit [EU] of the analog input EAX1 instrument	1000.0	1.2E-38	3.4E+38	Depends on the instrument
4x10217	D0108	Analog input value EAX1 in engineering unit [EU]	RO	1.2E-38	3.4E+38	Depends on the instrument

NOTE!
The analog signal EAX1 is mapped on the analog input channel E0 of the ALC11. For more details on the connections of this analog input channel, please refer to the electrical diagram of the respective panel.

The following alarm limits can be configured for this analog signal:

- Very high value limit (HH).
- High value limit (H).
- Low value limit (L).
- Very low value limit (LL).

The following table illustrate the parameters associated with these alarm limits for this analog signal.

Table 6.42 – Setting of the analog signal EAX1 limits

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0032	R0031	Enables handling of alarm limits associated with the analog signal EAX1	OFF	OFF	ON	- - -
4x0025	M0024	Bypass time or confirm EAX1 alarm	10	0	1800	Seconds
4x0076	M0075	EAX1: Time to confirm HH and H alarm limits condition	30	0	999	Seconds
4x0077	M0076	EAX1: Time to confirm LL and L alarm limits condition	30	0	999	Seconds
4x10097	D0048	Very high limit value associated with analogue signal EAX1	1000.0	1.2E-38	3.4E+38	Depends on the instrument
4x10099	D0049	High limit value associated with analogue signal EAX1	1000.0	1.2E-38	3.4E+38	Depends on the instrument
4x10101	D0050	Low limit value associated with analogue signal EAX1	0.0	1.2E-38	3.4E+38	Depends on the instrument
4x10103	D0051	Very low limit value associated with analogue signal EAX1	0.0	1.2E-38	3.4E+38	Depends on the instrument

6.14 ROD ROTATION SENSOR

The rod rotation sensor corresponds to a magnetic sensor connected to a digital input of the ACL11, used for indicate the rod rotation, thus being able to detect the rotation even with the system in a stopped status, thus verifying the situation of distortion of the rod. The table below illustrates the rod rotation reading parameter:

Table 6.43– Rod rotation sensor reading parameter

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x0419	M0418	Reading of rod rotation via digital input I0. During the ALC11 scan cycle. Counting pulses every 60 seconds	RO	0	32767	RPM

7 CONTROLLER SETTING BASE

The ALC11-PCP controller needs a group of setting parameters for its correct operation. These parameters are described in this document, clustered according to the system functionalities.

7.1 WELL GLOBAL SETTINGS

The ALC11-PCP controller needs a group of global parameters related to the respective well and pump configuration, as listed in the table below:

Table 7.1 – Well configuration

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x10009	D0004	Motor pulley diameter	60.0	20.0	500.0	mm
4x10011	D0005	Motor pulley diameter	240.0	50.0	5000.0	mm
4x10049	D0024	Head reduction relation	4	1	50	- - -

Additionally, it provides information-level parameters to the system operator, that is, parameters that are not actually used by the controller and are only provided as the well information to the system operator. These parameters are listed in the table below:

Table 7.2 – Well information

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x0018	M0017	Well base potential	10	1	1000	m³/d
4x10025	D0012	Motor rated current	75	0	10000	A
4x10051	D0025	Motor rated speed	1800	10	20000	RPM

7.1.1 Setting Commands

The table below illustrates the map of available commands to set the parameters related to the well:

Table 7.3 – Well setting commands

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0215	R0214	Command to initialize the well settings base with default values	OFF	OFF	ON	- - -
0x0207	R0206	Command to process new update of the system setting parameters	OFF	OFF	ON	- - -

■ R0214: Starts the well setting base with default values. These values restore factory default settings for a PCP well.

■ R0206: After changing any well or system setting parameter, it is necessary to execute this command to perform the respective processing related to the change in the parameters, such as saving the parameters to flash memory and logging the changed values into the SDCARD.

7.2 FILED INSTRUMENTATION SETTINGS

The various field-installed instruments, which are analog signals to the ALC11-PCP controller, must be properly set according to the specific parameters of each instrument.

7.2.1 Downhole Sensor Settings

In case the well is equipped with downhole pressure and temperature sensor that generate analog signals, it is necessary to set some parameters related to it listed, in the table below:

Table 7.4 – Downhole sensor settings via analog signal

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0005	R0004	ON = Downhole pressure and downhole temperature transmitter is present	OFF	OFF	ON	
4x10005	D0002	Maximum scale of the downhole pressure transmitter	1000.0	1.0	10000.0	psi
4x10007	D0003	Maximum scale of the downhole temperature transmitter	250.0	10.0	500.0	° C

7.2.2 Production Line Pressure Transmitter Settings

In case the well is equipped with a line pressure transmitter that generate analog signals, it is necessary to set some parameters related to it, listed in the table below:

Table 7.5 – Line pressure transmitter settings

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x10003	D0001	Maximum scale of the production line pressure transmitter	1000.0	1.0	10000.0	psi

7.3 GENERAL CONTROLLER SETTINGS

The ALC11-PCP controller requires a set of general parameters associated with the respective controller configuration, as listed in the table below:

Table 7.6 – System status information

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x0197	M0196	CMD: Return code of command execution: 0 = SUCCESS, nonzero indicates error code	0	-32768	32767	Bit 0..15
4x0198	M0197	CMD: Internal for ALC11	0	-32768	32767	Bit 0..15

Table 7.7 – Command codes for parameter M0196

Code	Description
10	Selects LOCAL mode
11	Selects REMOTE mode
22	"Run" mode only in local for ALC11Tools
23	"Ready" mode only in local for ALC11Tools
32	"Run" mode only in local for SISAL
33	"Ready" mode only in local for SISAL
42	“Run” mode in remote for supervisory (if necessary, not used)
43	“Ready” mode in remote for supervisory (if necessary, not used)
52	“Run” mode in remote for ALC11Tools
53	“Ready” mode in remote for ALC11Tools
61	Load current parameters from SDCARD ALC11
62	Update current ALC11 parameters in SDCARD
63	Load current parameters from SDCARD CFW11
64	Update current CFW11 parameters in SDCARD
65	Load (SDCARD → DEVICE) default parameters in SDCARD's CFW11
66	Update (DEVICE → SDCARD) CFW11 default parameters in SDCARD
67	Select method change for RP
68	Select method change for PCP
99	Reset CFW11 (internal command)

7.3.1 Controller RTC Setting

The RTC of the ALC11 controller can be configured and read through the addresses listed below, through M0197 the user sends the RTC write or read command, in variable M0196 we have the command return. When sent the value 200 the parameters in the following table show the values read from the RTC of ALC11, if sent 201 the controller will read the values in the table parameters and overwrite in the RTC.

Table 7.8 – ALC11 RTC information

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x0198	M0197	CMD: Internal for ALC11 200 – Read the RTC of the ALC11 controller 201 – Program the RTC of the ALC11 controller	0	-32768	32767	Bit 0..15
4x0197	M0196	CMD: Return code of command execution: 0 = SUCCESS, nonzero indicates error code	0	-32768	32767	Bit 0..15
4x0189	M0188	Day	- - -	1	31	- - -
4x0190	M0189	Month	- - -	1	31	- - -
4x0191	M0190	Year	- - -	1980	2047	- - -
4x0192	M0191	Hour	- - -	0	23	- -
4x0193	M0192	Minutes	- - -	0	59	- - -
4x0194	M0193	Seconds	- - -	0	59	- - -
4x0195	M0194	Day of Week (0..6, 0=Sunday, 1=Monday, etc.)	- - -	0	6	- - -

7.3.1 Controller IP Setting

The controller's IP configuration can be configured and read through the addresses listed below. Through M0197, in variable M0196 we have the return of the command, the user sends the command to write or read the IP. When the value 210 is sent, the parameters in the table below show the values read from the IP address of the ALC11, if sent 211 the controller will read the values in the table parameters and overwrite the IP address. The controller shows the IP in the following configuration: IP = IP1.IP2.IP3.IP4.

Table 7.9 – ALC11 IP information

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x0198	M0197	CMD: Internal for ALC11 210 = Read the controller IP address 211 = Program IP address of the controller	0	-32768	32767	Bit 0..15
4x0197	M0196	CMD: Return code of command execution: 0 = SUCCESS, nonzero indicates error code	0	-32768	32767	Bit 0..15
4x0192	M0191	IP4 address	200	0	259	- -
4x0193	M0192	IP3 address	0	0	259	- - -
4x0194	M0193	IP2 address	168	0	259	- - -
4x0195	M0194	IP1 address	192	0	259	- - -

After configuring a new IP, it is necessary to restart the controller, for that you have to write the security code in M0193 and M0194 and after writing the restart command in M0197.

Table 7.10 – Information for restarting ALC11

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x0198	M0197	CMD: Internal for ALC11 212 = Controller reset command	0	-32768	32767	Bit 0..15
4x0194	M0193	Security code 2 to reset ALC11 = 90 decimal	168	0	259	- - -
4x0195	M0194	Security code 1 to reset ALC11 = A5 Hexa = 165 decimal	192	0	259	- - -

8 CONTROLLER DATA

During its operation, the ALC11-PCP controller provides information on the status and information on the system and the well, as listed below:

- System Status: Status with the system general information.
- Fault and Alarm Status: Status with the system fault information.
- Well Data: Well information.

A more detailed description of this system information will be presented below.

8.1 SYSTEM STATUS

General information related to the controller operating status is provided. This information is provided in a set of "StsSys" variables, where each bit is related to a piece of status information, as described in the tables below:

Table 8.1 – System status information

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0141	R0140	OFF = Manual Mode / ON = Automatic Mode	RO	OFF	ON	- - -
0x0432	R0431	ON = Emergency actuated	RO	OFF	ON	- - -
0x0106	R0105	ON - Active alarm in the system	RO	OFF	ON	- - -
4x0141	M0140	ALC11 operation status	0	-32768	32767	Bit 0..15
4x0142	M0141	ALC status word	0	-32768	32767	Bit 0..15
4x0143	M0142	STS Operating mode for CFW11 HMI: 1 = Local 3 = Manual remote manual 4 = Automatic remote	RO	1	4	- - -
4x0422	M0421	Current rotation value on the rod	RO	0	32767	RPM
4x0441	M0440	Day	- - -	1	31	- - -
4x0442	M0441	Year	- - -	1	31	- - -
4x0443	M0442	Hour	- - -	1980	2047	- - -
4x0444	M0443	Minutes	- - -	0	23	- - -
4x0445	M0444	Seconds	- - -	0	59	- - -
4x0446	M0445	Day	- - -	0	59	- - -
4x0447	M0446	Day of Week (0..6, 0=Sunday, 1=Monday, etc.)	- - -	0	6	- - -
4x10171	D0085	Pump ON Time	RO	0	87000	h
4x10173	D0086	Pump OFF Time	RO	0	87000	h

Table 8.2 – System status information M0140

Bit	Status Description
0	On the ALC11-PCP controller startup
1	Timing system power-up delay time
2	Acoustic signal before starting the pump
3	Executing pump rocking start
4..7	Reserve

Table 8.3 – System status information M0141

Bit	Status Description
0	On the ALC11-PCP controller startup
1	Timing system power-up delay time
2	Acoustic signal before starting the pump
3	Executing pump rocking start
4..7	Reserve
8	Performing hydraulic brake test routine
9	Performing flow stabilization routine
10	Performing reversal/backspin stage 1 routine
11	Performing reversal/backspin stage 2 routine
12	Reversal/backspin end pulse (5 seconds)
13	Hydraulic brake test routine end pulse (only one pulse)
14	ALD11 frequency inverter enabled

8.2 FREQUENCY INVERTER STATUS

General information associated with the frequency inverter operating status are provided, as listed in the table below.

Table 8.4 – Frequency inverter status information

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0085	R0084	ON = Failure to access CFW11 via DPRAM	RO	OFF	ON	- - -
0x0087	R0086	Invalid controller date and time flag	RO	OFF	ON	- - -
0x0389	R0388	ON = Inverter with alarm	RO	OFF	ON	- - -
0x0390	R0389	ON = Inverter with undervoltage	RO	OFF	ON	- - -
0x0391	R0390	ON = Inverter in REMOTE, OFF = Inverter in LOCAL	RO	OFF	ON	- - -
0x0392	R0391	ON = Inverter with fault; ON = Inverter without fault	RO	OFF	ON	- - -
0x0393	R0392	ON = Motor running, OFF = Motor stopped	RO	OFF	ON	- - -
0x0394	R0393	ON = Inverter enabled, OFF = Inverter disabled	RO	OFF	ON	- - -
0x0395	R0394	ON = Forward run, OFF = Reverse run	RO	OFF	ON	- - -

8.3 SYSTEM I/O STATUS

Information related to the ALC11 and ALD11 I/O's is provided, as described in the tables below.

Table 8.5 – System digital I/O information

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x0375	M0374	Bit-mapped controller I/O map	0	-32768	32767	Bit 0...15
4x0376	M0375	Bit-mapped controller I/O map	0	-32768	32767	Bit 0...15
4x0377	M0376	Bit-mapped controller I/O map	0	-32768	32767	Bit 0...15

Table 8.6 – System digital I/O information M0374

Bit	Status Description
0	ALC11 - Digital output O0
1	ALC11 - Digital output O1
2	ALC11 - Digital output O2
3	ALC11 - Digital output O3
4...7	Reserve
8	ALD11 - Digital output O8
9	ALD11 - Digital output O9
10	ALD11 - Digital output O10
11...15	Reserve

Table 8.7 – System digital I/O information M0375

Bit	Status Description
0	ALC11 - Digital input I5
1...4	Reserve
5	ALC11 - Digital input I4
6	Reserve
7	ALD11 - Digital input I8
8	Reserve
9	ALC11 - Digital input I2 (inverted status)
10	ALD11 - Digital input I10
11	ALD11 - Digital input I11 (inverted status)
12	ALC11 - Digital input I2 (inverted status)
13	ALC11 - Digital input I3 (inverted status)
14...15	Reserve

Table 8.8 – System digital I/O information M0376

Bit	Status Description
0...7	Reserve
8	ALC11 - Digital input I0
9	ALC11 - Digital input I1
10	ALD11 - Digital input I9
11	ALD11 - Digital input I13 (inverted status)
12...15	Reserve

Table 8.9 – System analogic I/O information

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x0387	M0386	ALC11 - Analog input E0	RO	-1	4095	- - -
4x0399	M0398	ALC11 - Analog input E1	RO	-1	4095	- - -
4x0400	M0399	ALC11 - Analog input E2	RO	-1	4095	- - -
4x0392	M0391	ALC11 - Analog input E3	RO	-1	4095	- - -
4x0393	M0392	ALC11 - Analog input E4	RO	-1	4095	- - -
4x0394	M0393	ALC11 - Analog input E5	RO	-1	4095	- - -
4x0386	M0385	ALC11 - Analog input E6, load cell in 12 bits	RO	-4095	4095	- - -
4x0388	M0387	CFW11 - Analog input E7	RO	-1	4095	- - -
4x0398	M0397	CFW11 - Analog input E8	RO	-1	4095	- - -
4x0378	M0377	CFW11 - Analog output S0	RO	0	4095	- - -
4x0379	M0378	CFW11 - Analog output S1	RO	0	4095	- - -

8.4 ALARM STATUS

Information related to the ALC11 and ALD11 faults and alarms is provided, as described in the tables below.

Table 8.10 – Alarms and faults system information

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0088	R0087	Pump rocking start failure alarm	RO	OFF	ON	- - -
0x0089	R0088	Maximum motor torque limit alarm	RO	OFF	ON	- - -
0x0090	R0089	Minimum motor torque limit alarm	RO	OFF	ON	- - -
0x0091	R0090	Motor current lower limit alarm (LL)	RO	OFF	ON	- - -
0x0092	R0091	Motor current higher limit alarm (HH)	RO	OFF	ON	- - -
0x0093	R0092	Frequency inverter failure	RO	OFF	ON	- - -
0x0094	R0093	Line pressure higher limit alarm (HH)	RO	OFF	ON	- - -
0x0095	R0094	Downhole pressure lower limit alarm	RO	OFF	ON	- - -
0x0096	R0095	Downhole pressure higher limit alarm	RO	OFF	ON	- - -
0x0097	R0096	Downhole temperature higher limit alarm	RO	OFF	ON	- - -
0x0098	R0097	Invalid configuration parameters	RO	OFF	ON	- - -
0x0099	R0098	Possible line leakage warning	RO	OFF	ON	- - -
0x0100	R0099	Line leakage alarm	RO	OFF	ON	- - -
0x0102	R0101	Maximum limit of rod rotation alarm	RO	OFF	ON	- - -
0x0103	R0102	Minimum limit of rod rotation alarm	RO	OFF	ON	- - -
0x0104	R0103	Low line pressure warning, possible line leakage	RO	OFF	ON	- - -
0x0107	R0106	Status in line “LEAKAGE” condition	RO	OFF	ON	- - -
0x0332	R0331	Maximum line pressure limit failure (PSHH)	RO	OFF	ON	- - -
4x0371	M0370	Bit-mapped status flags for supervisory	0	-32768	32767	Bit 0...15
4x0407	M0406	Bit-mapped controller I/O map	0	-32768	32767	Bit 0...15
4x0408	M0407	Bit-mapped controller I/O map	0	-32768	32767	Bit 0...15
4x0410	M0409	Bit-mapped controller I/O map	0	-32768	32767	Bit 0...15

Table 8.11 – Alarm status information M0370

Bit	Type	Status Description
0	Alarm	Analog input EAX1 very high limit (HH)
1	Alarm	Analog input EAX1 high limit (H)
2	Alarm	Analog input EAX1 low limit (L)
3	Alarm	Analog input EAX1 very low limit (LL)
4...8	- - -	Not used in ALC11
9	Event	Internal fault in the ALC11 ladder application
10	Fault	Hardware failure in the ALC11 controller
11	Fault	COM1 serial communication failed
12	Fault	COM2 serial communication failed
13	Fault	COM3 serial communication failed
14	Event	Failed to access SDCARD
15	Alarm	ON = SDCARD not detected

Table 8.12 – Alarm status information M0406

Bit	Type	Status Description
0...1	---	Not used in ALC11
2	Event	VSD access or frequency converter fault
3	Fault	Production line very high pressure (HH)
4	Fault	Minimum downhole pressure
5	Alarm	Maximum downhole pressure
6	Fault	Maximum downhole temperature
7	Event	Invalid configuration base
8	Alarm	Possible production line leakage (L)
9	Fault	There is effective leakage in the production line (LL)
10	Event	Pump motor ON/OFF Status
11	---	Not used in ALC11
12	Fault	Maximum rod speed
13	Fault	Minimum rod speed
14	Event	RTC access error or invalid date and time on the controller
15	---	Not used in ALC11

Table 8.13 – Alarm status information M0407

Bit	Type	Status Description
0	Alarm	Production line high pressure (H)
1...2	---	Not used in ALC11
3	Alarm/fault	Motor Overload Fault or Alarm
4	Fault	External Fault
5	Alarm	External Alarm
6	Fault	Motor maximum torque
7	Fault	Motor minimum torque
8	Fault	Torque on the Rod Maximum HH limit
9	Alarm	Rod Torque Maximum Limit H
10	Alarm	Rod Torque Maximum Limit L
11	Fault	Rod Torque Maximum Limit LL
12	Fault	Motor winding temperature maximum limit HH
13	Alarm	Motor winding temperature maximum limit H
14	Fault	Pump rocking start fault
15	Event	Emergency actuated

Table 8.14 – Alarm status information M0409

Bit	Type	Status Description
0	Alarm	Leakage alarm
1	Fault	Leakage condition fault
2	Fault	Power supply fault
3	Fault	Controlled stop fault
4	Fault	Hydraulic brake test fault
5	Alarm	Low or no battery in the ALC11 CPU alarm
6...15	---	Not used in ALC11

8.5 PROCESS VARIABLES

ALD11 process variables are available, as described in the tables below.

Table 8.15 – Description of process variables

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x10203	D0101	Minimum speed to be configured on the VSD	RO	0	64476	RPM
4x10205	D0102	Maximum speed to be configured on the VSD	RO	0	64476	RPM
4x10209	D0104	Motor current	RO	0	64476	A
4x10211	D0105	Line pressure	RO	0	64476	psi
4x10213	D0106	Downhole pressure	RO	0	64476	psi
4x10215	D0107	Downhole temperature	RO	0	64476	° C
4x10217	D0108	Rod speed	RO	0	64476	RPM
4x10221	D0110	Pt100 1: R-Phase Winding	RO	-20	250	° C
4x10223	D0111	Pt100 2: S-Phase Winding	RO	-20	250	° C
4x10225	D0112	Pt100 3: T-Phase Winding	RO	-20	250	° C
4x10257	D0128	Mechanical ratio calculated according to the configuration of the pulleys	RO	0	64476	- - -
4x10267	D0133	Current rod speed (RPM) calculated by the controller with data read from VSD	RO	0	64476	RPM
4x10271	D0135	Calculated minimum value allowed for motor current (RPM) from minimum rod speed	RO	0	64476	RPM
4x10273	D0136	Calculated maximum allowed value for the motor current (RPM) from the maximum rod speed	RO	0	64476	RPM
4x10275	D0137	Calculated minimum value allowed for rod speed (RPM) from P133, used for operation in local mode	RO	0	64476	RPM
4x10277	D0138	Calculated maximum allowed value for rod speed (RPM) from P134, used for operation in local mode	RO	0	64476	RPM
4x10281	D0140	End rod speed reference (RPM) to be sent to VSD	RO	0	64476	RPM

9 ALARM MANAGEMENT

9.1 MOTOR OVERLOAD

The Motor Overload protection is based on curves that simulate the motor heating and cooling in cases of overload, according to IEC 60947-4-2 and UL 508C. The motor overload protection fault and alarm codes are F0072 and A0046 respectively and are displayed in bit 03 of M0406.

The motor overload is given as a function of the reference value In x FS (motor rated current multiplied by the duty factor), which is the maximum value at which the overload protection must not actuate, because the motor can work continuously at that value without damages.

Parameter P0348 allows configuring the wanted protection level for the motor overload protection. The possible options are: Fault and Alarm, Fault only, Alarm only and motor overload function disabled. The motor overload protection alarm actuation level (A046) is set via P0349.

Table 9.1 – Motor overload protection

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x8156	P0156	Overload Current 100%	1,05 x Inom-ND	0	2565.0	A
4x8157	P0157	Overload Current 50%	0,9 x Inom-ND	0	2565.0	A
4x8158	P0158	Overload Current 5%	0,65 x Inom-ND	0	2565.0	A
4x8348	P0348	Motor overload setting: 0 = Inactive 1 = Fault/Alarm 2 = Fault 3 = Alarm	1	0	3	- - -
4x8349	P0349	Ixt alarm level	85	70	100	%
4x0408	M0407	Bit 03 - Motor Overload Fault or Alarm	0	0	1	- - -

9.2 EXTERNAL FAULT / ALARM

It is possible to program the inverter DI6 for no external fault/alarm, and this function will indicate "External Alarm" (A090) or “External Fault” (F091) on the HMI display when the programmed digital input is open (0 V). If +24 V is applied to the input, the alarm message will automatically disappear from the HMI display; in case of a fault message, it is necessary to reset the drive. If DI6 is programmed for alarm, the motor continues working normally, regardless of this input status.

Table 9.2 – External Fault / Alarm

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x8266	P0266	DI6 Function: 18 = No External Alarm 19 = No External Fault	23	0	31	- - -
4x0408	M0407	Bit 04 - External Fault	0	0	1	- - -
4x0408	M0407	Bit 05 - External Alarm	0	0	1	- - -

9.3 LEAKAGE CONDITION FAULT

In order to avoid soil contamination and production losses in the unit, the system has tools for oil leakage monitoring by means of discrete signals connected to the inverter input 03. Considering the normally closed input, that is, while the input is in status 01 (closed), the system is normal without leakage. In remote mode it is possible to disable this fault through R0003.

Table 9.3 – Leakage condition fault

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0004	R0003	ON = Enables leakage monitoring (digital signal)	ON	OFF	ON	- - -
4x0410	M0409	Bit 01 - Leakage condition fault	0	0	1	- - -

9.4 EMERGENCY ACTUATED

Aiming at the operators and equipment integrity, the panel has an emergency push-button connected to the inverter input 04 in the normally closed state, that is, while the input is in status 01 (closed), the system is normal.

Table 9.4 – Emergency actuated

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x0410	M0409	Bit 15 – Emergency actuated	0	0	1	- - -

9.5 REVERSAL FAULT

To prevent the system from trying to execute the system controlled stop for a long time, a maximum controlled stop time is set (P1042). If this time is exceeded, the inverter generates the reversal fault.

Table 9.5 – Reversal fault

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x9042	P1042	Reversal Fault Time	60	0	32000	s
4x0410	M0409	Bit 03 - Controlled stop fault	0	0	1	- - -

9.6 HYDRAULIC BRAKE TEST FAULT

If the brake test is enabled, the inverter will start the motor in reverse direction at a fixed speed. During a predefined time, the minimum brake pressure value being read at the inverter analog input 02 must be reached. If this minimum pressure is not reached, the brake test fault will be generated.

Table 9.6 – Hydraulic brake test fault

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x9028	P1028	Hydraulic brake minimum pressure	40	0	100	%
4x0410	M0409	Bit 04 - Hydraulic brake test fault	0	0	1	- - -

9.7 POWER SUPPLY FAULT

Aiming at preserving the system integrity, the SRW (protection relay) detects problems in the power supply and disables the input contactor. The SRW signals a power supply fault by means of the inverter input 05.

Table 9.7 – Power supply fault

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x0410	M0409	Bit 02 - Power supply fault	0	0	1	- - -

9.8 LEAKAGE ALERT

In order to avoid soil contamination and production losses in the unit, the system has tools to monitor oil leakage by means of discrete signals or direct measurement of the production line pressure. This monitoring is done by means of a digital input signal linked to the "APPP" type leakage sensor. This alert can be disabled via R0003.

Table 9.8 – Leakage alert

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0004	R0003	ON = Enables leakage monitoring (digital signal)	ON	OFF	ON	- - -
4x0410	M0409	Bit 00 – Leakage alarm	0	0	1	- - -

9.9 PRODUCTION LINE PRESSURE ALARM

The ALC11 can monitor the production line pressure. This monitoring is performed by means of discrete signals or analog signal and enables the diagnostics of abnormal conditions in the production line; it can be configured to generate alarms and stop the unit.

9.9.1 Production Line Low Pressure

The monitoring of the minimum production line pressure is enabled by means of a controller R-type variable, as listed in the table below:

Table 9.9 – Enabling of the production line low pressure alarm

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0021	R0020	*Flag* to enable/disable the monitoring of the production line low pressure limit by analog input or pressure switch of the production line, where: • ON = Enables the monitoring of the low pressure limit • OFF = Disables the monitoring of the low pressure limit	ON	OFF	ON	- - -

This monitoring provides resources to identify leakages in the production line, and in this condition oil pumping can be inhibited by turning off the pumping unit. The following limits are related to the production line minimum pressure:

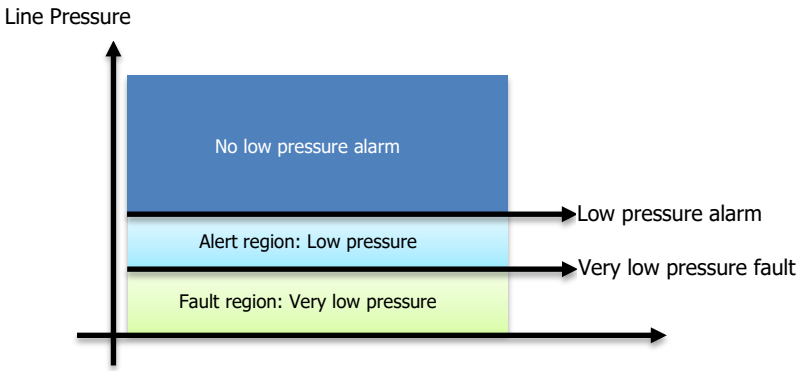

Figure 9.1 – Alarm limits for production line low pressure

■ "Low pressure" Alarm Limit: Limit value to signal the low pressure alarm condition. When the pressure reaches values below the "Low pressure" limit and above the "Very low pressure", an alarm indicating low pressure is displayed.

■ "Very low pressure" Fault Limit: Limit value to display the very low pressure fault condition. When the pressure reaches values below the "Very low pressure" minimum limit, a "Very low pressure" fault is generated, causing the pumping unit to shut down. Also, a line underpressure pressure switch in the production line is connected to input I2.

NOTE!
In this context, the "Alarm Limit" value must be greater than the value related to the "Fault Limit", so that the alarm condition is displayed first, and then the effective minimum pressure fault condition.

Table 9.10 – Configuration of the alarm limits for line low pressure

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x10027	D0013	Production line low pressure alarm limit	0.0	0.0	100000.0	psi
4x10029	D0014	Production line very low pressure alarm limit	0.0	0.0	100000.0	psi
0x0003	R0002	ON = Enables the return to operation after a very low pressure fault (LL) ends	ON	OFF	ON	- - -
0x0209	R0208	Command for recognition of production line very low pressure (leakage) alarm	- - -	OFF	ON	- - -
0X0409	R0408	Production line low pressure (L) alarm	RO	OFF	ON	- - -
0X0410	R0409	Production line very low pressure fault (LL)	RO	OFF	ON	- - -

9.9.2 Production Line High Pressure

The production line high pressure monitoring is enabled by means of a controller R-type variable as listed in the table below:

Table 9.11 – Enabling of the production line high pressure alarm

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0022	R0021	*Flag* to enable/disable the monitoring of the production line high pressure limit, where: • ON = Enables the monitoring of the high pressure limit • OFF = Disables the monitoring of the high pressure limit	ON	OFF	ON	- - -

The following limits are related to the production line high pressure:

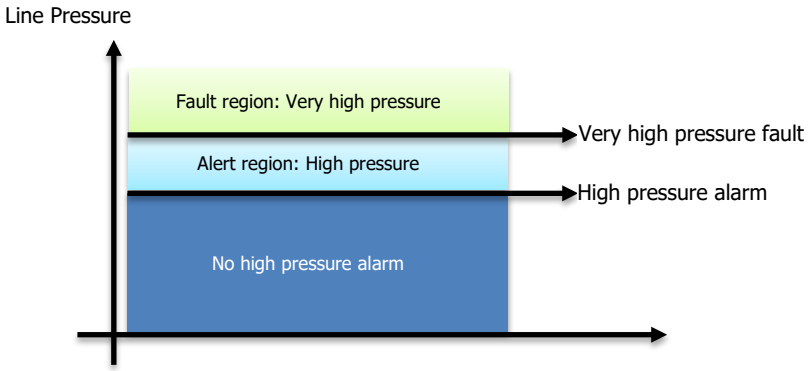

Figure 9.2 – Alarm limits for production line high pressure

■ "High pressure" Alarm Limit: Limit value to display the high pressure alarm condition. When the pressure reaches values above the "High pressure" and below the "Very high pressure", an alarm indicating high pressure is displayed.

■ "Very high pressure" Fault Limit: Limit value to display the very high pressure fault condition. When the pressure reaches values above the "Very high pressure" maximum limit, a "Very high pressure" fault is generated, causing the pumping unit to shut down. Also, a line underpressure pressure switch in the production line is connected to input I3.

NOTE!
In this context, the "Alarm Limit" value must be lower than the value associated with the "Fault Limit", so that the alarm condition is first displayed, and then the effective maximum pressure fault condition.

Table 9.12 – Configuration of the alarm limits for line high pressure

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0X0008	R0007	ON = Enables return to operation after a very high pressure fault (HH) ends	ON	OFF	ON	- - -
0X0010	D0009	Production line very high pressure limit (HH)	1000.0	0.0	10000.0	psi
4X10053	D0026	Production line high pressure limit (H)	1000.0	0.0	10000.0	psi
4X0011	M0010	Time to confirm the production line high (h) and very high pressure (HH)	30	0	320	s
0x0417	R0416	Production line high pressure alarm (H)	RO	OFF	ON	- - -
0x0404	R0403	Production line very high pressure fault (HH)	RO	OFF	ON	- - -

By means of parameter M0010, it is possible to specify a time to confirm the respective high pressure condition of the production line. For example, if this parameter is set to “15”, it means that if within 15 seconds the high pressure condition of the production line persists, this respective condition will be processed and signaled by the controller.

9.10 TORQUE ON THE ROD FAULT

The ALC11 can monitor the torque on the rod. This monitoring is done by calculating the total pump reduction to estimate the rod torque based on the torque calculated by the inverter.

The monitoring of the torque on the rod is enabled by means of a controller R-type variable, as listed in the table below:

Table 9.13 – Enabling the torque alarm on the rod

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0019	R0018	*Flag* to enable/disable the monitoring of the torque on the rod limit, where: • ON = Enables the monitoring of the torque on the rod • OFF = Disables the monitoring of the torque on the rod	ON	OFF	ON	- - -
4x10079	D0039	Motor rated torque	160.8	1.0	100000.0	Nm
4x10081	D0040	Torque on the rod maximum limit	50000.0	1.0	100000.0	Nm
4x10265	D0132	Current torque on the rod (Nm) calculated by the ALD11-PCP controller	RO	0.0	3.4E+38	Nm

9.10.1 Low Torque on the Rod

This monitoring provides resources to identify torque on the rod, and in this condition the oil pumping can be inhibited by turning off the pumping unit. The following limits are related to low torque on the rod:

■ “Low torque on the rod”, Alarm Limit: Limit value to display the low torque alarm condition. When the torque reaches values below the “Low torque” limit and above the “Very low torque” limit, an alarm indicating low torque is indicated.

■ “Very low torque”, Fault Limit: Limit value to indicate the very low torque fault condition. When the torque reaches values below this “Very low torque” minimum limit, a "Very low torque” fault is generated, causing the pumping unit to shut down.

NOTE!
In this context, the “Alarm Limit” value must be greater than the value of the “Fault Limit”, so that the alarm condition is indicated first, and then the effective minimum torque fault condition.

Table 9.14 – Configuration of the alarm limits for low torque on the rod

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x10075	D0037	Low torque on the rod limit (L)	10000.0	0.0	100000.0	Nm
4x10077	D0038	Very low torque on the rod limit (LL)	8000.0	0.0	100000.0	Nm
0x0427	R0426	Low torque on the rod alarm (L)	RO	OFF	ON	- - -
0x0428	R0427	Very low torque on the rod fault (LL)	RO	OFF	ON	- - -

9.10.2 High Torque on the Rod

The following limits are related to the high torque on the rod:

■ "High torque on the rod" Alarm Limit: Limit value to indicate the high torque alarm condition. When the torque reaches values above the "High Torque" limit and below the "Very high torque" limit, an alarm indicating high torque is displayed.

■ "Very high torque" Fault Limit: Limit value to indicate the very high torque fault condition. When the torque reaches values above this "Very high torque" maximum limit, a "Very high torque" fault is generating, causing the pumping unit to shut down.

NOTE!
In this context, the "Alarm Limit" value must be lower than the value of the "Fault Limit", so that the alarm condition is indicated first, and then the effective maximum torque fault condition.

Table 9.15 – Configuration of the alarm limits for high torque on the rod

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x10071	D0035	Very high torque on the rod limit (HH)	45000.0	1.0	100000.0	Nm
4x10073	D0036	High torque on the rod limit (H)	43000.0	1.0	100000.0	Nm
0x0425	R0424	Very high torque on the rod fault (HH)	RO	OFF	ON	- - -
0x0426	R0425	High torque on the rod alarm (H)	RO	OFF	ON	- - -

9.11 PUMP ROCKING START FAULT

When the pump rocking start function is activated the ALC will make N attempts to unlock it. If it cannot unlock it, maximum torque in the pumping direction reached, the system will signal the Pump Rocking Start Fault.

9.12 MINIMUM TORQUE FAULT

The ALC11-PCP controller can monitor the torque. If the torque value is below the minimum torque limit, the controller will signal minimum torque fault and disable the pump. These fault parameters are listed in the table below.

Table 9.16 – Configuration for the monitoring of the motor minimum torque

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0016	R0015	ON = Enables the monitoring of the motor minimum torque	ON	OFF	ON	- - -
4x0048	M0047	Time to confirm motor minimum torque condition	120	0	6600	s
4x10069	D0034	Motor minimum torque limit	15.0	0.0	100.0	%
0x0424	R0423	Motor minimum torque fault	RO	OFF	ON	- - -

9.13 MAXIMUM TORQUE FAULT

The ALC11-PCP controller can monitor the torque. If the torque value is above the maximum torque limit, the controller will indicate maximum torque reached. In this state, the controller will send the pump speed reference equal to the relief speed. After M0045 time elapses, the ALC sends the previous speed reference. If the torque limit is reached again in a period of time below M0047, the controller will disable the pump. These fault parameters are listed in the table below:

Table 9.17 – Configuration for the monitoring of the motor maximum torque

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0015	R0014	ON = Enables the monitoring of the motor temperature	ON	OFF	ON	- - -
4x0046	M0045	Time to wait for the 1nd condition of the motor maximum torque	60	0	600	s
4x0047	M0046	Time to wait for the 2nd condition of the motor maximum torque	180	60	3000	s
4x10067	D0033	Motor reduced speed reference when reaching maximum torque	800	0	3600	RPM
0x0423	R0422	Motor maximum torque fault	RO	OFF	ON	- - -

9.14 DOWNHOLE SENSOR

The ALC11 can monitor the downhole temperature and pressure. This monitoring is done by means of the downhole sensor via analog signal or via Modbus communication.

The alarm configuration parameters will be displayed according to the selected background sensor, which can be via analog signal or via Modbus communication

The downhole temperature and pressure monitoring is enabled by means of a controller R-type variable, as listed in the table below:

Table 9.18 – Enabling of the downhole temperature and pressure alarm

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0005	R0004	*Flag* to enable/disable the monitoring of the downhole temperature and pressure limit, where: • ON = Enables the monitoring of the downhole temperature and pressure • OFF = Disables the monitoring of the downhole temperature and pressure	OFF	OFF	ON	- - -

If the downhole sensor has been configured via Modbus communication and there is a communication failure, a system failure will be generated, thus causing the pump to stop.

Table 9.19 – Modbus communication fault with downhole sensor

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0005	R0144	Modbus communication fault with downhole sensor	OFF	OFF	ON	- - -

9.14.1 Minimum Downhole Pressure

This monitoring provides resources to identify minimum downhole pressure, and in this condition the oil pumping can be inhibited by turning off the pumping unit. The following limits are related to the downhole pressure:

Table 9.20– Configuration for the monitoring of the minimum downhole pressure

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x10129	D0064	Downhole pressure low limit (Modbus only)	2	1	10000.0	bar/psi
4x10031	D0015	Minimum limit for downhole pressure	1.0	1	10000.0	psi
0x0405	R0404	Minimum downhole pressure fault	RO	OFF	ON	- - -
0x0142	R0142	Downhole pressure L limit alarm (Modbus only)	RO	OFF	ON	- - -

9.14.2 Maximum Downhole Pressure

This monitoring provides resources to identify maximum downhole pressure, and in this condition the oil pumping can be inhibited by turning of the pumping unit. The following limits are related to the Downhole Pressure:

Table 9.21 – Configuration for the monitoring of the maximum downhole pressure

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x10033	D0016	Maximum limit for downhole pressure	10000.0	1	10000.0	psi
0x0406	R0405	Minimum downhole pressure fault	RO	OFF	ON	- - -

9.14.3 Maximum Downhole Temperature

This monitoring provides resources to identify maximum downhole temperature, and in this condition the oil pumping can be inhibited by turning off the pumping unit. The following limits are related to the Downhole Temperature:

Table 9.22 – Configuration for the monitoring of the maximum downhole temperature

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x10133	D0066	Downhole temperature high limit (Modbus only)	80	10.0	500.0	° C
4x10035	D0017	Downhole temperature maximum limit	250.0	10.0	500.0	° C
0x0407	R0406	Maximum downhole temperature fault	RO	OFF	ON	- - -
0x0143	R0143	Downhole temperature H limit alarm	RO	OFF	ON	- - -

9.15 MOTOR TEMPERATURE

The ALC11 can monitor the motor temperature. This monitoring is done by means of 3 PT100.

The downhole temperature and pressure monitoring is enabled by means of a controller R-type variable, as listed in the table below:

Table 9.23 – Enabling of the motor temperature alarm

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0018	R0017	*Flag* to enable/disable the monitoring of the motor temperature limit, where: • ON = Enables the monitoring of the motor temperature • OFF = Disables the monitoring of the motor temperature	ON	OFF	ON	- - -

The controller provides an alarm and a fault level. When the alarm limit is exceeded, an alarm is indicated. In case the fault limit is exceeded, the controller inhibits the oil pumping by turning off the pumping unit. The following limits are related to the motor temperature.

Table 9.24 – Configuration for motor temperature

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x10061	D0030	Limit for very high motor temperature (HH), phases R, S and T	100.0	0	250.0	° C
4x10063	D0031	Limit for high motor temperature (H), phases R, S and T	90.0	0	250.0	° C
0x0429	R0428	Motor very high temperature fault (HH)	RO	OFF	ON	- - -
0x0430	R0429	Motor high temperature alarm (H)	RO	OFF	ON	- - -

10 DATA HISTORY

The controller provides resources to store history data related to the process. These data can be stored in a SDCARD in the ALC11.

10.1 HISTORY IN THE SDCARD

The ALC11-PCP controller can be equipped with a SD CARD to store process history data. The following history data are provided:

- Well operation data history.
- Event history associated with the well.
- History of changes in the system configuration.

10.1.1 Process Data History

10.1.1.1 History Configuration

For the data history related to the well operation, parameters described in the table below are available.

Table 10.1 – Configuration for process data history

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x0024	M0023	Time interval for storing process data in the SDCARD	30	0	1440	Min
4x0023	M0022	Interval for card history	0	0	24	hours

NOTE!
If parameter M0043 is set to 0 (zero), this process data log is disabled.

10.1.1.2 Recording of History Data

At each time interval configured for the history data, a record with the following information is stored in the SDCARD:

- Date and time the data are recorded in the SDCARD
  - Format: DD/MM/AAAA HH/MN/SS
  - Example: "25/10/2016 12:25:00"
- P0002: Motor Speed (0 to 18000 RPM)
- P0007: Output voltage (0 to 2000 V)
- P0004: DC Link Voltage (0 to 2000 V)
- Alarm status 1 bit-mapped
- Alarm status 2 bit-mapped
- Alarm status 3 bit-mapped
- Status 1 bit-mapped
- Control cabinet internal temperature (-20 ... 80 ºC) * 10
- Control cabinet internal humidity (0 ... 100%) * 10
- Rod speed calculated by the ALC11 (RPM)
- Dynamic level (meters)
- Rod speed (RPM)
- Line pressure value (psi)
- P0001 Speed Reference (0 to 18000 RPM)
- P0003 Motor Current (0.0 to 4500.0 A)
- P0005 Motor Frequency (0.0 to 1020.0 Hz)
- P0010 Output Power (0.0 to 6553.5 kW)
- P0009 Motor Torque (-1000.0 to 1000.0 %)

- Rod torque calculated by the ALC11-PCP controller (Nm)
- Winding temperature Phase R (º C)
- Winding temperature Phase S (º C)
- Winding temperature Phase T (º C)

10.1.2 Event History

10.1.2.1 History Configuration

NOTE!
There are no configuration parameters associated with the event history.

10.1.2.2 Recording of History Data

At each relevant system event, a record with the following information is stored in the SDCARD:

- Date and time the event is recorded in the SDCARD
  - Format: DD/MM/AAAA HH/MN/SS
  - Example: "25/10/2016 12:25:00"
- Event type in 16-bit integer values with signal
  - 1001: System event
  - 1002: Alarm generated by the ALC11
  - 1003: Fault generated by the ALC11
  - 1010: Alarm generated by the ALD11
  - 1011: Fault generated by the ALD11
  - 1012: Fault history read by the ALD11
- Code of the event stored

10.1.3 Parameter Change History

10.1.3.1 History Configuration

NOTE!
There are no configuration parameters associated with the parameter change history.

10.1.3.2 Recording of History Data

At each system parameter change, either of the ALC11 or the ALD11, a record with the following information is stored in the SDCARD:

- Date and time the parameter change was recorded in the SDCARD
  - Format: DD/MM/AAAA HH/MN/SS
  - Example: "25/10/2016 12:25:00"
- Code associated with the type of parameter changed in the system, where:
  - 0: Parameter R of the ALC11
  - 1: Parameter M of the ALC11
  - 2: Parameter D of the ALC11
  - 3: Parameter L of the ALC11
  - 10: Parameter P of the ALD11
- Number of the changed par
- Previous value of the changed parameter
- New current value of the changed parameter

10.2 HISTORY IN THE ALC11

The ALC11 provides a circular buffer with some process history data in its own RAM memory.

10.2.1 History Configuration

This history is composed of a data register with 4 process variables. The activation to log history data, the interval in which these data are logged and the process variables that make up this respective data record can be set by the user, as described in the table below:

Table 10.2 – Configuration of the history data record

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0101	R0100	ON = Disables the history data log in circular buffer of the ALC11	OFF	OFF	ON	- - -
4x0037	M0036	History data record type	0	0	2	- - -
4x0031	M0030	History data record interval	600	1	32000	s
4x0024	M0023	Time interval for storing process data in the SDCARD	30	0	1440	min

NOTE!
Whenever parameters M0036 and M0030 are changed, the circular buffer must be reset to ensure that the data contained in the respective buffer are consistent with these parameters. In this sense, when these parameters are changed, a command must be executed to clear the data stored in the buffer to ensure this consistency with the historical data.

The commands related to this historical data buffer are presented in the table below.

Table 10.3 – Commands related to the historical data buffer

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
0x0206	R0205	Command to reset the history data buffer	OFF	OFF	ON	- - -

10.2.2 History Data

By means of parameter M0036, it is possible to select which process variables are stored in the buffer, as described in the table below:

Table 10.4 – History data record values

Record code	Description
M0036 = 0	History data record type code = 0: ■ Motor current [A] ■ Line pressure [psi] ■ Downhole pressure [psi] ■ Rod speed [RPM]
M0036 = 1	History data record type code = 1: ■ Motor current [A] ■ Line pressure [psi] ■ Motor torque [%] ■ Rod speed [RPM]
M0036 = 2	History data record type code = 2: ■ Motor current [A] ■ Line pressure [psi] ■ Motor speed [RPM] ■ Rod speed [RPM]

10.2.3 History Data Buffer

History data records are stored in a buffer mapped on the controller base M, as described in the table below:

Table 10.5 – History data buffer

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x0501 .. 4x1300	M0500 .. M1299	History data buffer (800 M-type memories)	- - -	-32768	32767	- - -
0x0210	R0209	CMD: Reset storage counter	- - -	0	1	- - -
4x1305	M1304	Storage buffer M current index. Value scale from 500 to 1300, with intervals of four values, like 500, 504, 508, etc., since each data record contains 4 M variables	- - -	500	1300	- - -
4x1310	M1309	Acquisitions counter since last buffer reading (0..200)	- - -	0	200	- - -
4x1305 … 4x1308	M1305 .. M1307	Date and time of the last data record stored in the history data buffer	- - -	-32768	32767	Bits 0..15

This buffer can store up to 200 history data records, and since each record has 4 variables, it totals a buffer with 800 M-type variables:

■ The “Amz_Idx” variable contains the address including the last data record value stored in the buffer. The purpose of this record is to allow the buffer to be read optimally when the buffer is not completely filled, that is, when the buffer is not full (500 <Amz_Idx <1300).

■ The “Amz_Cnt” variable contains the number of additional data records that have been stored in the buffer since the last time the supervisory read the buffer. This register must be reset by the supervisory at the end of each reading of the history data buffer. By means of this variable, the supervisory can determine the amount of additional data records necessary for reading from its last reading, optimizing the communication flow for history data acquisition. For example, if this variable has value 10, it indicates that it is enough to acquire the last 10 most recent records from the historical data buffer.

■ The variable “Amz_Rtc” corresponds to a 3-variable vector that contains the date and time linked to the last data record inserted in the history data buffer. Note that since the previous data records are logged considering a fixed time interval set in variable M0030, it is possible to calculate the log time of the oldest data record stored in the history data buffer.

Considering that the data buffer is full, the oldest data record is in the “Amz_Buf [500..503]” positions, and the most recent history record is in the “Amz_Buf [1296 1299]”. When a new data record is inserted, the oldest record is discarded, and the new record is inserted at the end of the respective buffer.

The table below illustrates the date and time field format associated with the most recent data record logged in the historical data buffer.

Table 10.6 – Date and time format mapping

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x1306	M1305	Bit 0..7 = seconds (0..59) Bit 8..15 = day of the week (1..7, 1 = Sunday, 2 = Monday, etc.)	- - -	-32768	32767	Bits 0..15
4x1307	M1306	Bit 0..7 = minutes (0..59) Bit 8..15 = hours (0..23)	- - -	-32768	32767	Bits 0..15
4x1308	M1307	Bit 0..5 = day of the month (1..31) Bit 6..9 = month (1..12) Bit 10..15 = year, 1990 offset must be added	- - -	-32768	32767	Bits 0..15

10.2.4 History Events

This history stores alarms, faults and events that occurred in the pumping unit, making it possible through these historical records to evaluate the sequence of events that occurred in the well, as well as providing data for statisticians associated with the reasons for stopping. These data can be made available through a report generated by the ALC11Tools application and exported to files in PDF and CSV format.

There are no configuration parameters associated with this event history as events are logged as they occur during the operation of the system.

Each event data record stored in the SDCARD has the following information:

- Timestamp of the history record
  - Description: Instant of the SD CARD event log.
  - Format: DD/MM/YYYY HH/MN/SS.
  - Example: 25/05/2016 12:25:00.

- Event information in 16-bit integer values with signal
  - Description: List of data with event type information.
    - Code of the type of event to be logged, where:
      - 1001: System event.
      - 1002: Alarm generated by the ALC11.
      - 1003: Fault generated by the ALC11.
      - 1010: Alarm generated by the ALD11.
      - 1011: Fault generated by the ALD11.
      - 1012: Fault history read by the ALD11.
    - Event identification code.
  - To obtain the complete list associated with the two codes above, you must refer to the text file “eve.rc” available on the ALC11-PCP SD CARD, inside the “PCP” directory.

- Additional information associated with the event, in floating point, with two decimal places
  - Description: Additional information for each event, when relevant.
    - Context information for each type of event.
    - Context information for each type of event.
  - For example, when logging an alarm, you can log the current value of the variable and the respective alarm limit configured for the alarm.

These records are stored in files per day, keeping the records of the last 15 days.

Table 10.7 – Parameters associated with history process data

Modbus Address	Parameter	Description	Default	Min.	Max.	Unit
4x2276	M2275	LOG EVE: TimeStamp of event occurrence	0	0	32767	- - -
4x2277	M2276	LOG EVE: TimeStamp of event occurrence	0	0	32767	- - -
4x2278	M2277	LOG EVE: Event type (event, alarm, fault)	0	0	32767	- - -
4x2279	M2278	LOG EVE: Event code	0	0	32767	- - -

11 COMMUNICATION

The ALC11 provides three RS485 serial communication channels and one Ethernet connection.

11.1 ETHERNET

The ALC11 module provides a female RJ45 type Ethernet connector. It is possible to communicate with the controller through this interface via:

- Ethernet Crossover cable when connected directly to the computer.
- Standard Ethernet cable (Type V) when connected to a hub, switch, or router.

NOTE!
If the connected computer has an Ethernet interface with Auto-MDIX resource, a crossover cable is not required, and a standard Ethernet cable can be used.

NOTE!
Use Ethernet network cables following EIA/TIA-568-B.2 standards, category 5e or superior.

11.1.1 Operation Modes

The Ethernet channel is capable to operate with the following settings:

Table 11.1– Ethernet channel operation modes

Speed	Communication
10 Mbps	Full Duplex
10 Mbps	Half Duplex
100 Mbps	Full Duplex
100 Mbps	Half Duplex

The settings are automatically detected.

11.1.2 Transportation and Application Protocols

The Ethernet channel provides the following transportation protocols:

- TCP/IP.
- UDP.
- UDP-Broadcast.

These protocols mentioned above can carry packages using the application protocols:

- MODBUS-TCP.

The Ethernet channel provides 4 simultaneous connections: three intended for users, called user's sockets 1, 2 and 3, and an equipment management connection, called control socket (socket 0). The user can use any of these 4 connections. The control connection has fixed settings, and cannot be changed. Thus, it is possible to make up to 4 simultaneous connections.

11.1.3 Factory Parameters

The table below indicates the factory parameters for the Ethernet channel:

Table 11.2– Ethernet channel factory parameters

Parameter	Value
IP Address	192.168.0.200
Gateway IP	192.168.0.1
Subnet mask	255.255.255.0
Connection timeout.	200 ms
Number of connection attempts	8

11.2 SERIAL RS485

The ALC11 provides three RS485 serial communication channels identified as COM1, COM2 and COM3. These three serial interfaces are galvanically isolated from the equipment hardware, but they are not isolated from each other.

11.2.1 Technical Data

Table 16.3– Technical data of the serial interfaces

Parameter	Value
Baud Rate	1200, 2400, 4800, 9600, 19200, 38400, 56800, 115200
Data bits	7 or 8
Parity	None, even, odd
Stop bits	1 or 2
Protocol	Modbus-RTU
Mode	Master or slave
Maximum number of RS485 network nodes	256 (*)

(*) The RS485 standard defines a minimum number of nodes supported by the network as 32. For 256-node operation, all network drivers must be of the low-power type (1/8 load).

NOTE!
Always use twisted pair, with ground mat in the RS485 network.

11.3 ACCESS TO THE MEMORY MAP VIA MODBUS TCP/RTU

This section shows how to access the controller addresses using a Modbus TCP or Modbus RTU connection.

11.3.1 Accessing R Type Addresses

The R-type addresses correspond to 8-bit Boolean variables. These markers can only receive values "0" or “1”. Add “1” to the desired R to obtain the Modbus address, as shown in the equation below:

Rxxxx=XXXX+1

Example:

Desired R: 50
Address = 50 + 1 = 0x0051

11.3.2 Accessing M Type Addresses

The M-type addresses correspond to 16-bit integer variables with signal. These markers can only receive values from “- 32767” to “32768”. Add “1” to the desired M to obtain the Modbus address, as shown in the equation below:

Mxxxx=XXXX+1

Example:

Desired M: 140
Address = 140 + 1 = **4x0141**

11.3.3 Accessing D Type Addresses

The D-type addresses correspond to 32-bit floating point variables. These markers can only receive values from “0” to “2^32-1”. To obtain the desired D Modbus address, use the equation below:

Dxxxx=2·XXXX+10000+1

Example:

Desired D: 80
Address = 80*2 + 10001 = **4x_10161**

12 COMMISSIONING AN APPLICATION WITH ALC11-PCP

Below is an example of a commissioning panel with ALD11. To start the pumping unit operation, we present the procedure sequence. Initially with operation in local mode and later in manual or automatic remote mode. Following the procedures in the form of flowcharts.

12.1 SEQUENCE TO START THE PUMP IN LOCAL MODE

Here is the sequence for starting the pump unit in LOCAL mode.

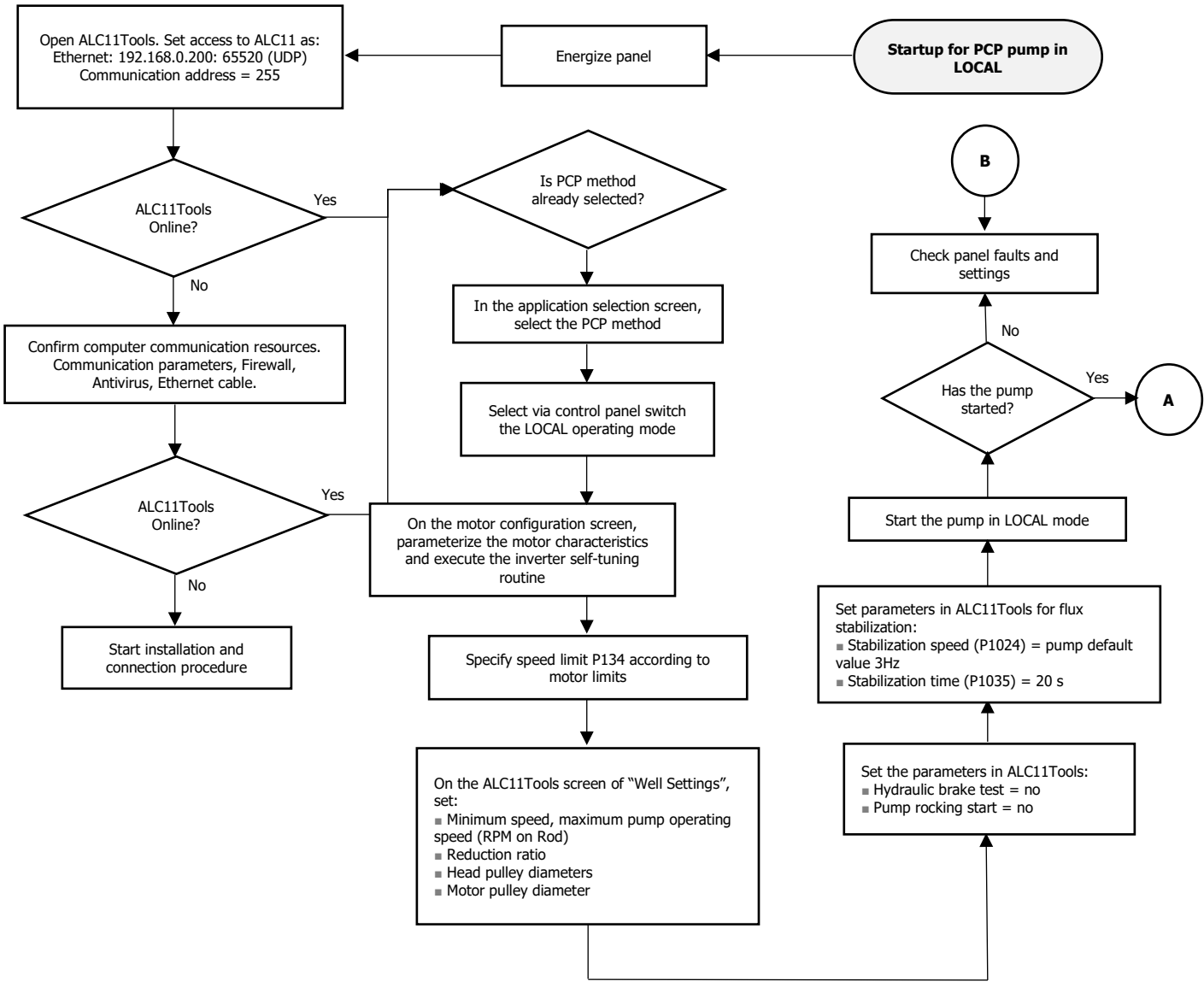

Figure 12.1 – Procedure to start the pump in LOCAL mode (part 1)

Continuation of the flow chart to start the pump in LOCAL mode.

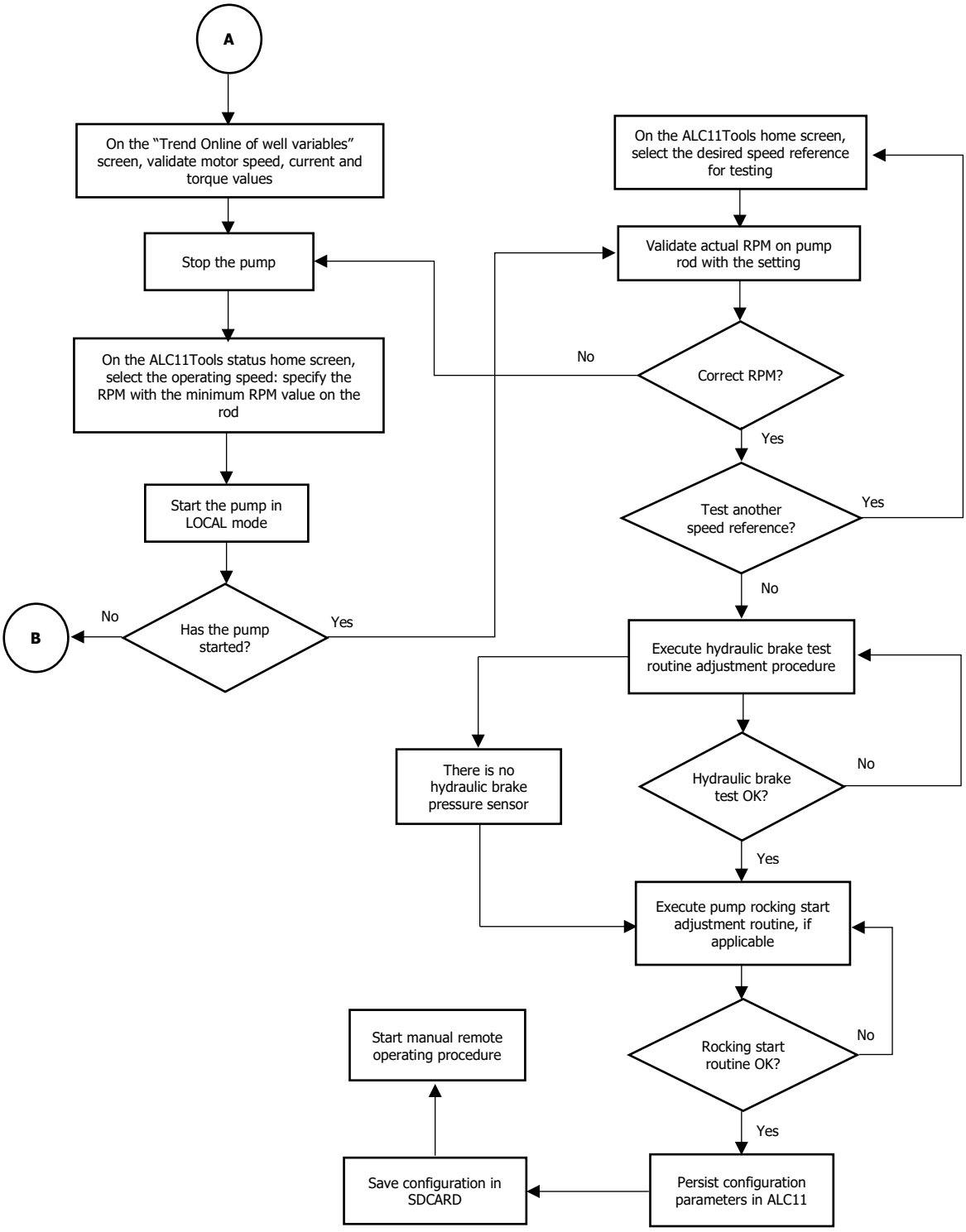

Figure 12.2 – Procedure to start the pump in LOCAL mode (part 2)

12.1.1 Hydraulic Brake Validation

During the pump start in local mode, we perform the pump hydraulic brake validation, described in the flow chart below.

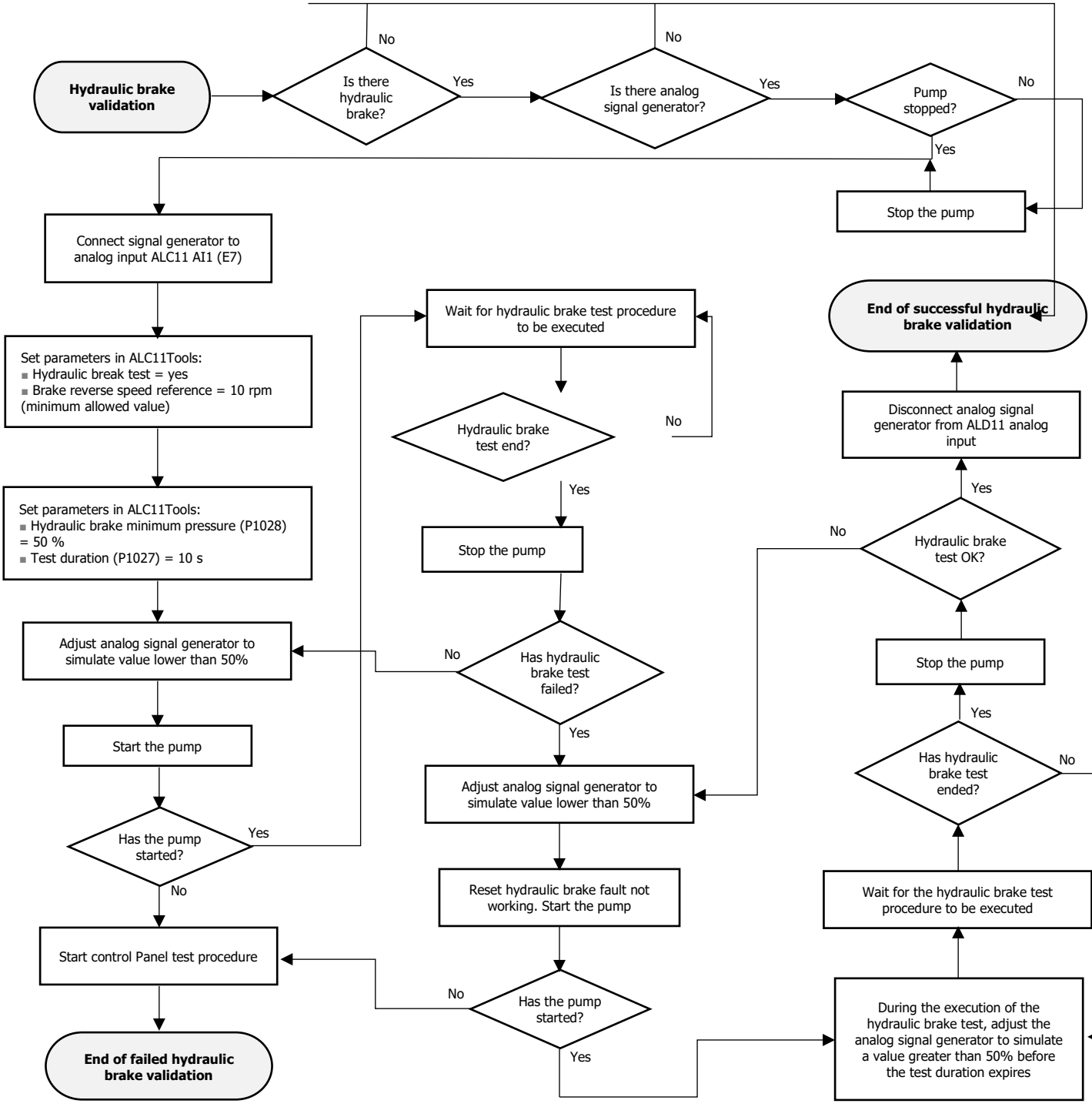

Figure 12.3 – Hydraulic brake validation procedure

12.1.2 Rocking Start Test

During the pump start in local mode we perform the pump rocking start routine, described in the flow chart below.

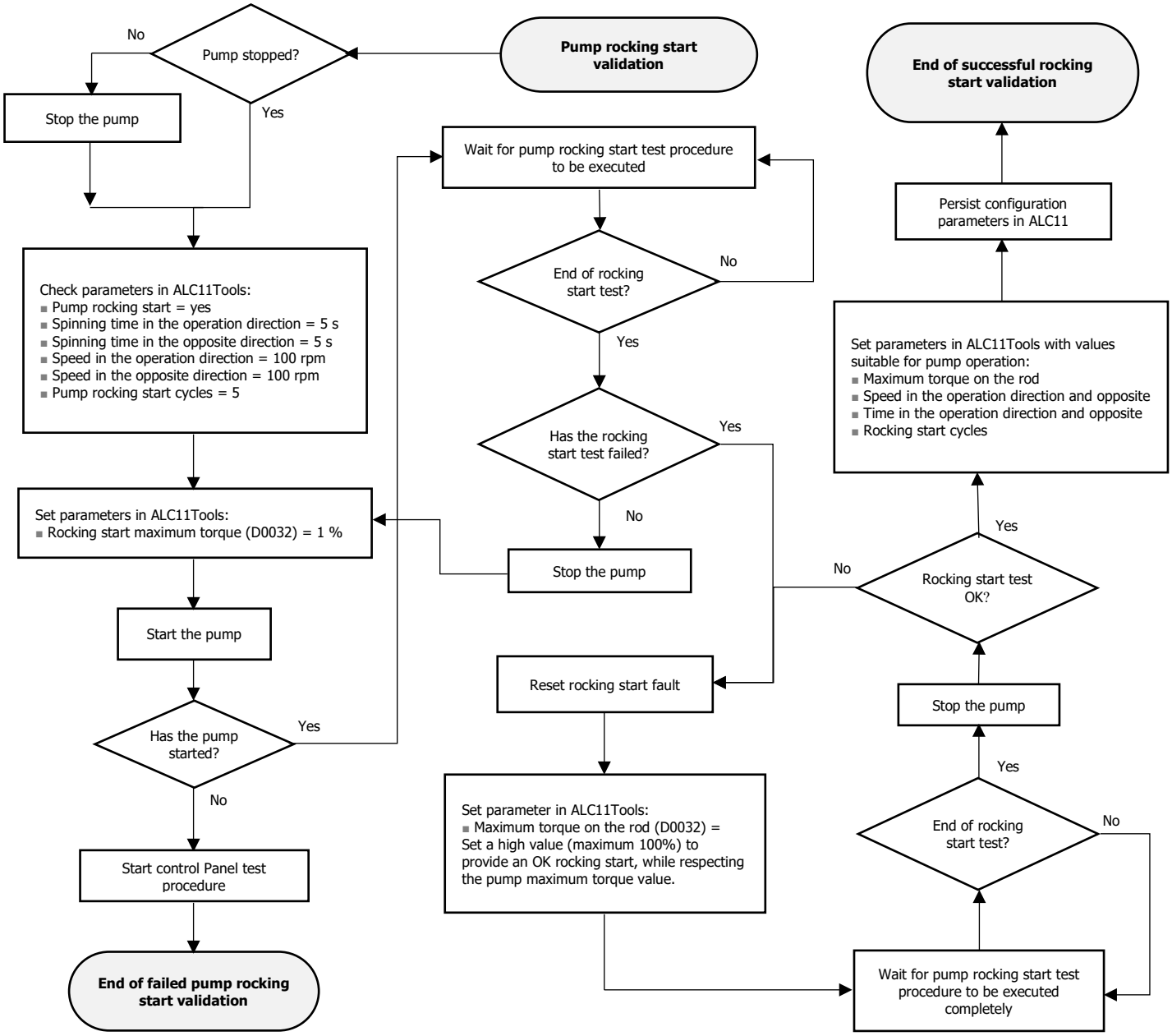

Figure 12.4 – Pump rocking start validation procedure

12.2 SEQUENCE TO START THE PUMP IN MANUAL OR AUTOMATIC REMOTE MODE

Here is the sequence for starting the pump unit for manual or automatic REMOTE mode.

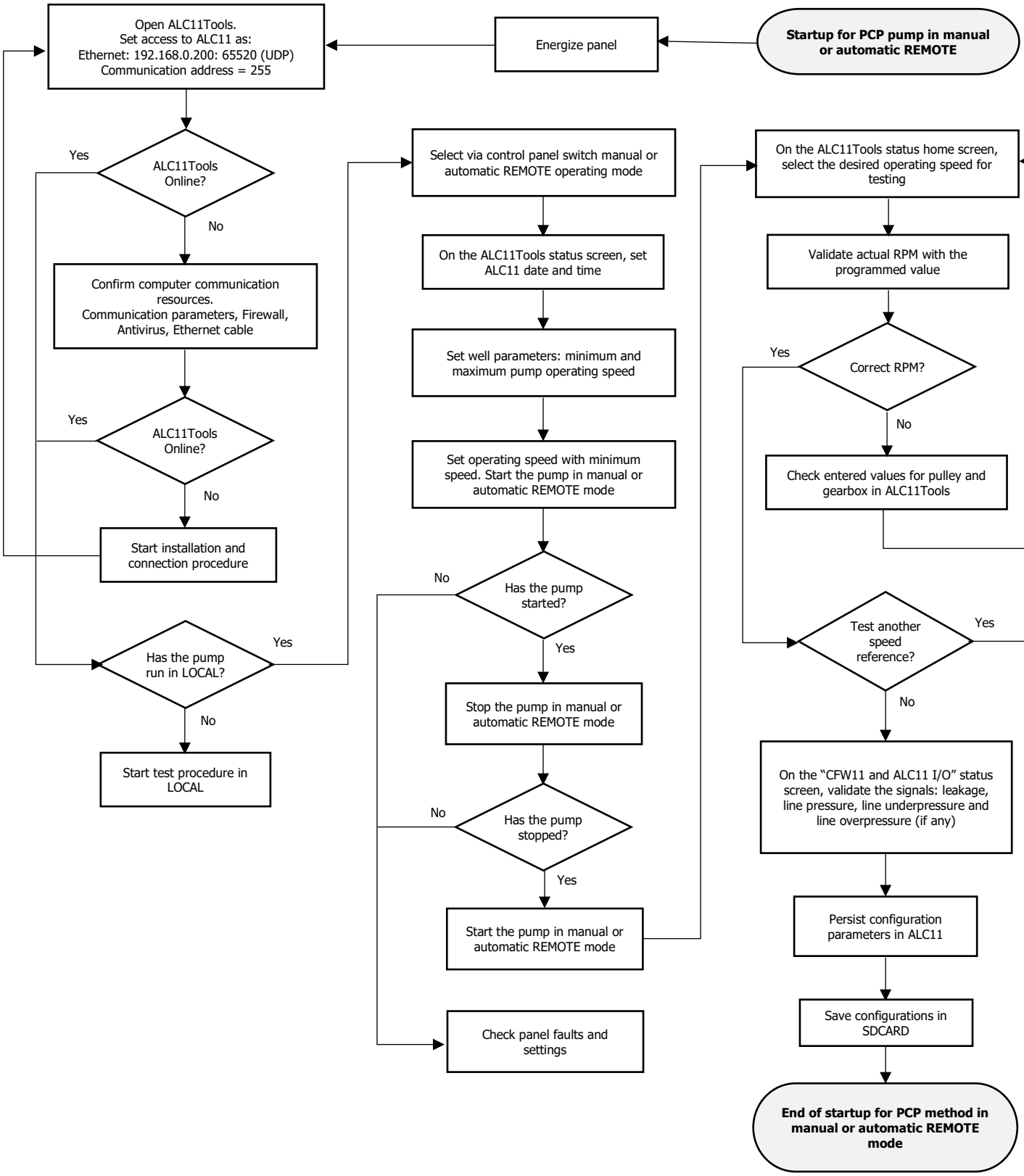

Figure 12.5 – Procedure to start the pump in manual or automatic REMOTE mode