User's Manual

Logimac 280VM_T, PLC based control system with color touch screen operator interface

Version : February , 2013

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SYSTEM PARAMETERS' DEFAULT SETTINGS

FUNCTION KEY	PLC REGISTER	PARAMETER	INITIAL VALUE	NOTES
Main Screen	-	Language F - French E - English	E - English	
Parameters	102	New password	9	
Parameters	24 526	# of pumps in PARAllel (in simultaneous operation) Flush hour	2 24H	2- parallel operation 1-one pump only 24H-Flush disable
Parameters	2	Start 1 delay	10 s	
Parameters	5	Start 2 delay	10 s	
Parameters	8	Blocking delay P1	15 s	
Parameters	11	Blocking delay P2	15 s	
Parameters	20	Alarm delay	5s	On Power up only
Parameters	132	M1/M2 closing delay	10s	
Parameters	590/592	Flowmeter scaling	0-80l/s	
Parameters	70/72	Min/Max Level scaling	0-5.00 m	
Parameters	74	Start 1 level	1.00 m	
Parameters	75	Start 2 level	1.20 m	
Parameters	76	Stop 1 level	0.50 m	
Parameters	77	Stop 2 level	0.50 m	
Parameters	107 106	High level alarm Low level alarm	2.00 m 0 m	
Parameters	96	P1 max. current	.50 A	
Parameters	98	P1 max. current	50 A	
Parameters	111 601	P1 high current alarm Delay	35 A 30s	
Parameters	112 604	P2 high current alarm Delay	35 A 30s	
Parameters	100 607	P1 low current alarm Delay	0 A 30s	
Parameters	101 610	P2 low current alarm Delay	0 A 30s	
Parameters	-	ALTERNATE Mode Choice	ON	ON OFF toggle P1lead/P2lead
Parameters	94	M-zone Inferior Level	0.80m	L280CAP only
Parameters	95	M-zone superior Level	0.90m	L280CAP only
Parameters	1060	M-zone AREA	0 m^2	Required for inflow calculation
Parameters	113/2033	1P Cnom/Cref	0 l/s	Cnom-required for inflow calculation
Parameters	115/2035	2p Cnom/Cref	0 l/s	Cnom- required for inflow calculation
Parameters	114	Capacity histeresis	0 l/s	L280CAP only
Parameters	1503/1505/ 1504/1506	Frequency:Min/Start/Max/D	30/36/60/09 Hz	L280VFD only

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PLC READ-ONLY DATA REGISTER READING

FUNCTION KEY of OPERATOR INTERFACE	PLC REGISTER	PARAMETER	READINGS 1	2	3	4	5	6	7
OPERATIONAL DATA	146, 143	Runtime P1 TOTAL							
OPERATIONAL DATA	176, 173	Runtime P1 /DAY							
OPERATIONAL DATA	155, 152	Runtime P2 TOTAL							
OPERATIONAL DATA	185, 182	Runtime P2 /DAY							
OPERATIONAL DATA	164, 161	Runtime P12 TOTAL							
OPERATIONAL DATA	194, 191	Runtime P12 /DAY							
OPERATIONAL DATA	217, 214	Overflow runtime							
OPERATIONAL DATA	202	No. of starts P1							
OPERATIONAL DATA	205	No. of starts P2							
OPERATIONAL DATA	208	Hi level occurrences							
MAIN SCREEN	220	Overflow occurrences							
MAIN SCREEN	1503/1505/1504/1506	Freq:Min/Start/Max/D							L280VFD only
MAIN SCREEN	1501/1502	SpeedP1/SpeedP2							
MAIN SCREEN	596	Flowmeter reading							
MAIN SCREEN	136/223	P1/P2 current							
MAIN SCREEN	74 ,2	Start 1 Level & delay							
MAIN SCREEN	75, 5	Start 2 Level & delay							
MAIN SCREEN	76 77	Stop 1 Level Stop 2 Level							
MAIN SCREEN	70, 72	Level Range							
MAIN SCREEN	1400	Pumped volume total							
MAIN SCREEN	1402	Pumped volume/day							
MAIN SCREEN	1645	Dynamic inflow							
MAIN SCREEN	1024	Cycle inflow							L280CAP only
MAIN SCREEN	1300	P1Capacity calcul.							L280CAP only
MAIN SCREEN	1302	P2Capacity calcul.							L280CAP only
MAIN SCREEN	1308	2P Capacity calcul.							L280CAP only
ALARM LOGGER	270	Alarm register							

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INTRODUCTION

The **LOGIMAC® 280VM_T P/N 13-50 90 93** as designed for the control and supervision of a sewage pumping station with one or two pumps.

The complete system consists of programmable logic controller **LOGIMAC® 280VM_T-PLC** as per the configuration specified in the following chapter, the operator interface **LOGIMAC® 280VM_T-OP.**

LOGIMAC® 280VM_T-PLC takes an analog level signal 4-20 mA from any of the level sensor with that kind of output.

The controller can be used in one of the three programmed MODE which is set before shipping:

- **L280** as previous Logimac 280CIM
- **L280CAP** with pumps' capacities calculation
- **L280VFD** with VFD control following the level changes

Dynamic inflow & pumped volume can be calculated in any of modes.

1.1 Approvals

Sensor: CSA certified for operation in **Class I, Division 2, Groups C and D hazardous environments**.
(Note: For this approval to be valid special installation conditions apply).

1.2 Part numbers

LOGIMAC® 280VM_T-PLC (P/N 13-50 90 94
Analog I/O expansion unit (P/N 13-40 02 30)
LOGIMAC® 280VM_T-OP (P/N 13-50 90 95)
Cable PLC-MMI (P/N 13-40 02 19)

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2. HARDWARE DESCRIPTION

2.1 LOGIMAC® 280-PLC CONFIGURATION

The programmable logic controller (PLC) is composed of the modules specified in the table 2.1 below depending on power supply module .

2.1 CONFIGURATION of **LOGIMAC® 280VM_T-PLC**

ITEM #	DESCRIPTION	TECHNICAL DATA
P/N 13-50 90 93	CPU & Memory	Flash user memory program memory: 24 Kwords storage memory: 32 Kwords operation speed: 1.0 ms/ 1Kword of logic user program: L280VM _40_T
	24 - inputs	24V DC; current consumption: 7.3mA max./point
	16 relays outputs	Operating voltage: 5-30 V DC 5-250 V AC max. load: 2A resistive/ 0.6A inductive
	Supply	120V AC (102 -132V), 60 Hz (47- 63 Hz) DC output power supply: 24V + -10%, 435 mA max. current
	Dimensions	(90H x 150W x76D) mm
	service temperature stocking temperature	0..+55˚C -40..+85˚C
	Port	Two serial ports: 1: RS 232, 2: RS 232 (BY DEFAULT) Optional port 2: RS485, Ethernet, USB
	Removable terminal strip	included
P/N 13-40 02 30	Analogue Expansion unit 4-inputs/2-outputs	Inputs: current 4-20mA outputs: current 4-20mA Supply : 120V AC (102 -132V), 60 Hz (47- 63 Hz) Dimensions: 90H x 95W x76D) mm

2.2 OPERATOR INTERFACE LOGIMAC® 280VM_T-OP

The operator interface LOGIMAC® 280VM_T-OP is is a fully programmable man-machine interface. One part of a programming can be done using the software, specific for the unit, and another one should be programmed in the PLC program software for PLC ladder programming.

The operator interface is equipped of:

- 6.5" Touch screen graphic display 640x480 pixels
- Real-time clock
- Application memory 12MB
- 10/100Mbit/s Ethernet port (RJ45)
- PLC communication port RS 232
- RS422/RS485 serial port
- USB Host & USB device ports
- cable: operator interface-PLC (DB9F- RG45)
- The supply voltage 24VDC (20-30V)
- Power consumption: Normal 0.4A @ 24VDC, Max 0.9A
- Dimensions: (219 x 154 x 6)mm mounting depth 55 mm
- Operation temperature 0-+50degC
- Storage temperature -20 to+70degC

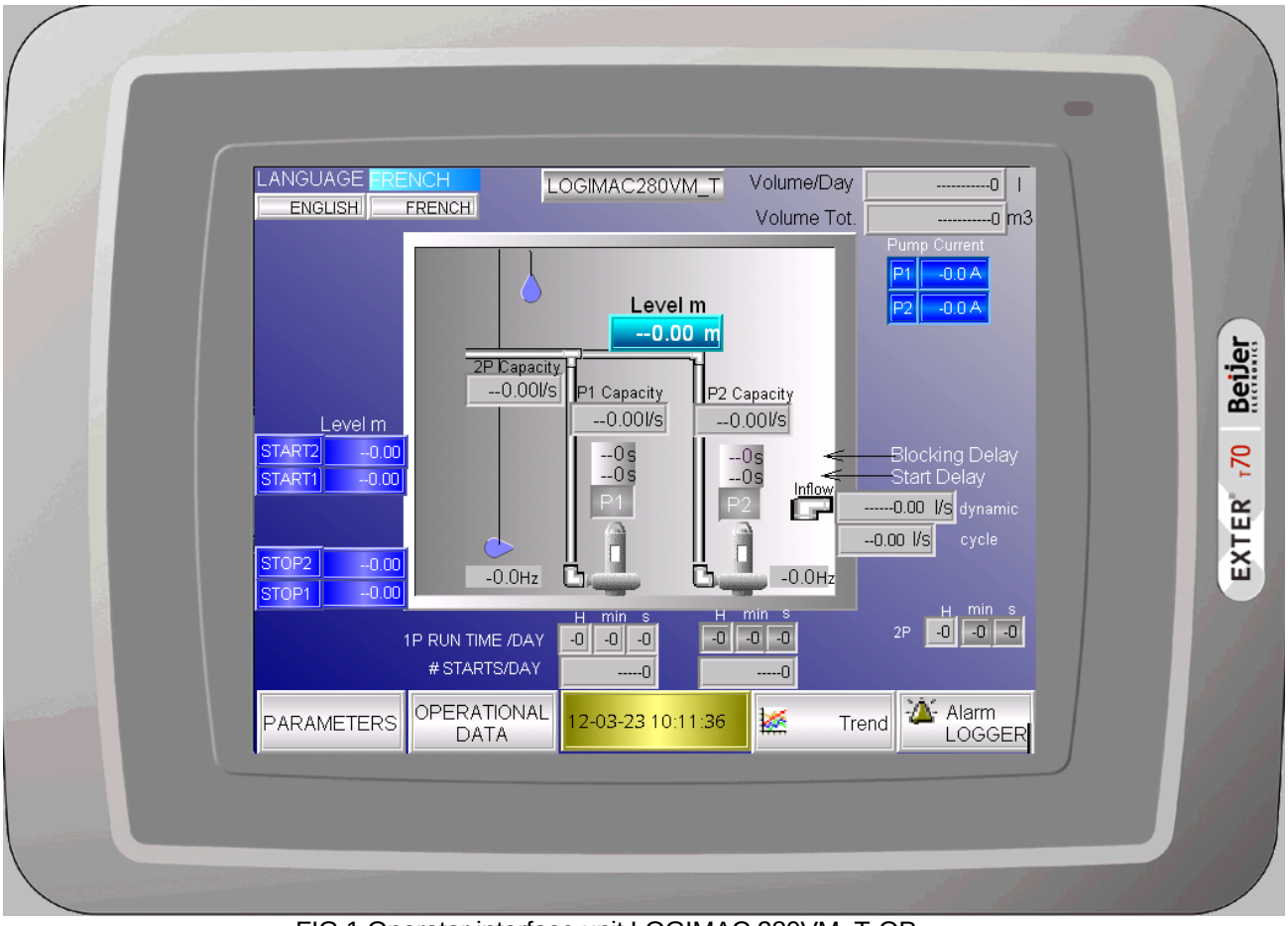

FIG.1 Operator interface unit LOGIMAC 280VM_T-OP

The operator interface was fully programmed for this application (see description of this programming in chapter 5 of this manual).

For further details, please refer to the manufacturer user manual supplied with unit.

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3. LOGIMAC® 280VM_T-PLC INPUT & OUTPUT CONNECTION

LOGIMAC® 280VM_T-PLC has 24 digital inputs, 16 digital relay-based outputs and 4 analog 4-20 mA inputs & 2 analog outputs. For this application the inputs and outputs are assigned to the signals specified in the table 1, 2, 3 and 4 respectively.

TABLE 1.: DIGITAL INPUT ASSIGNATION

INPUT	DESCRIPTION	NOTES
1	ACKNOWLEDGE/ RESET	signal provided by push button "ACKNOWLEDGE/ RESET
2	P1 AUTO	P1 mode selector in AUTO position
3	P2 AUTO	P2 mode selector in AUTO position
4	GEN SET RUN	GEN SET RUN NO contact. If closed , one pump only is allowed to run (no parallel operation of two pumps)
5	OL1(B1)	contact indicating overcurrent of the P1 pump (breaker auxiliary contact)
6	R6 leakage. P1	interface relay contact from Mini CAS II unit indicating a water leakage in P1 pump
7	R5 high temp. P1	interface relay contact from Mini CAS II unit indicating a high temperature in P1 pump
8	OL2(B2)	contact indicating overcurrent of the P2 pump (breaker auxiliary contact)
9	R8 leakage P2	interface relay contact from Mini CAS II unit indicating a water leakage in P2 pump
10	R7 high temp.P2	interface relay contact from Mini CAS II unit indicating a high temperature in P2 pump
11	FLH or ISRH high level	contact indicating the high level reached (follows FLH float NO contact)
12	Overflow (optional)	contact indicating the overflow level reached.(FLOV float NO contact)
13	FLL or ISRL low level	contact indicating the low level reached (follows FLL float NC contact)
14	PFD	voltage or phase failure detection (PFD)
15	M1 contactor closed	auxiliary contact of the M1 contactor to indicate the contactor status
16	M2 contactor closed	auxiliary contact of the M2 contactor to indicate the contactor status
17-24	SPARE	

For wiring details see project drawing

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TABLE 2.: DIGITAL OUTPUT ASSIGNATION

OUTPUT	DESCRIPTION	NOTES
1	PLC OK	Active if PLC is running
2	M1 closing signal	order to close the M1 contactor (interface relay R1)
3	M2 closing signal	order to close the M2 contactor (interface relay R2)
4	**COMMON** alarm	Common alarm signal for remote transmission (interface relay R14)
5	High level alarm	HIGH LEVEL alarm signal (120V AC circuit)
6	Low level alarm	LOW LEVEL alarm signal
7	P1 OVERLOAD alarm	P1 OVERLOAD alarm signal
8	P2 OVERLOAD alarm	P2 OVERLOAD alarm signal
9	P1 leakage alarm	P1 Leakage. alarm signal
10	P2 leakage alarm	P2 Leakage. alarm signal
11	P1 high temp. alarm	P1 High TEMP. alarm signal
12	P2 high temp. alarm	P2 High TEMP. alarm signal
13	M1 contactor closing fault	activated if M1 contactor does not close its contact during ten (10) seconds following the order to close (R1 relay contact closing)
14	M2 contactor closing fault	activated if M2 contactor does not close its contact during ten (10) seconds following the order to close (R2 relay contact closing)
15	SPARE	
16	Alarm Active	Alarm active for self dialed modem (activated for each new alarm for the time set as Modem Time; Default 5 minutes)

For wiring details see project drawing

TABLE 3 ANALOG INPUT ASSIGNATION

INPUT	DESCRIPTION	Notes
1	Level signal	Level signal from an ultrasonic sensor. Use the operator interface for scaling
2	P1 current signal (optional)	P1 pump current signal from current transducer. Use the operator interface for scaling
3	P2 current signal (optional)	P2 pump current signal from current transducer. Use the operator interface for scaling
4	Flowmeter	Signal of flow from Flowmeter (4-20mA)

For wiring details see project drawing

TABLE 4 ANALOG OUTPUT ASSIGNATION

OUTPUT	DESCRIPTION	Notes
1	P1 VFD signal	4-20 mA signal to control VFD (P1) following level changes
2	P2 VFD signal	4-20 mA signal to control VFD (P2) following level changes

For wiring details see project drawing

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4. PLC PROGRAM DESCRIPTION

4.1 INITIAL PARAMETERS WRITING

During the first scan or coldstart of the program the initial default parameters are automatically written to the assigned memory registers. TABLE 4 presents the list of the parameters and their default values. An operator can read or change (write) these parameters using operator interface of the table (see 5.2 chapter for details).

TABLE 4: SYSTEM PARAMETERS' DEFAULT SETTINGS

FUNCTION KEY/SCREEN	PLC REGISTER	PARAMETER	INITIAL VALUE	NOTES
MAIN SCREEN	-	Language French English	English	
Parameters	102	New password	9	
Parameters	24 526	# of pumps inPARAllel (in simultaneous operation) Flush hour	2 24H	2- parallel operation 1-one pump only 24H-Flush disable
Parameters	2	Start 1 delay	10 s	
Parameters	5	Start 2 delay	10 s	
Parameters	8	Blocking delay P1	15 s	
Parameters	11	Blocking delay P2	15 s	
Parameters	20	Alarm delay	5s	On Power up only
Parameters	132	M1/M2 closing delay	10s	
Parameters	590/592	Flowmeter scaling	0-80l/s	
Parameters	70/72	Min/Max Level scaling	0-5.00 m	
Parameters	74	Start 1 level	1.00 m	
Parameters	75	Start 2 level	1.20 m	
Parameters	76	Stop 1 level	0.50 m	
Parameters	77	Stop 2 level	0.50 m	
Parameters	107 106	High level alarm Low level alarm	2.00 m 0 m	
Parameters	96	P1 max. current	50 A	
Parameters	98	P1 max. current	50 A	
Parameters	111 601	P1 high current alarm Delay	35 A 30s	
Parameters	112 604	P2 high current alarm Delay	35 A 30s	
Parameters	100 607	P1 low current alarm Delay	0 A 30s	
Parameters	101 610	P2 low current alarm Delay	0 A 30s	
Parameters	-	ALTERNATE Mode Choice	ON	ON OFF toggle P1lead/P2lead
Parameters	94	M-zone Inferior Level	0.80m	L280CAP only
Parameters	95	M-zone superior Level	0.90m	L280CAP only
Parameters	1060	M-zone AREA	0 m^2	Required for inflow calculation
Parameters	113/2033	1P Cnom/Cref	0 l/s	Cnom-required for inflow calculation
Parameters	115/2035	2p Cnom/Cref	0 l/s	Cnom- required for inflow calculation
Parameters	114	Capacity histeresis	0 l/s	L280CAP only
Parameters	1503/1505/1504/1506	Frequency:Min/Start/Max/D	30/36/60/09 Hz	L280VFD only

4.2 ANALOG INPUT/OUTPUT READING & SCALING

All analog inputs are based on 12-bit analog-digital converter. During each scan of program 12 bits are converted in 16-bit analog data word %AI. Factory scaling for analog inputs of 4-20 mA and the corresponding level and the pump current scaling for the default ranges is provided on fig.2 and 3.

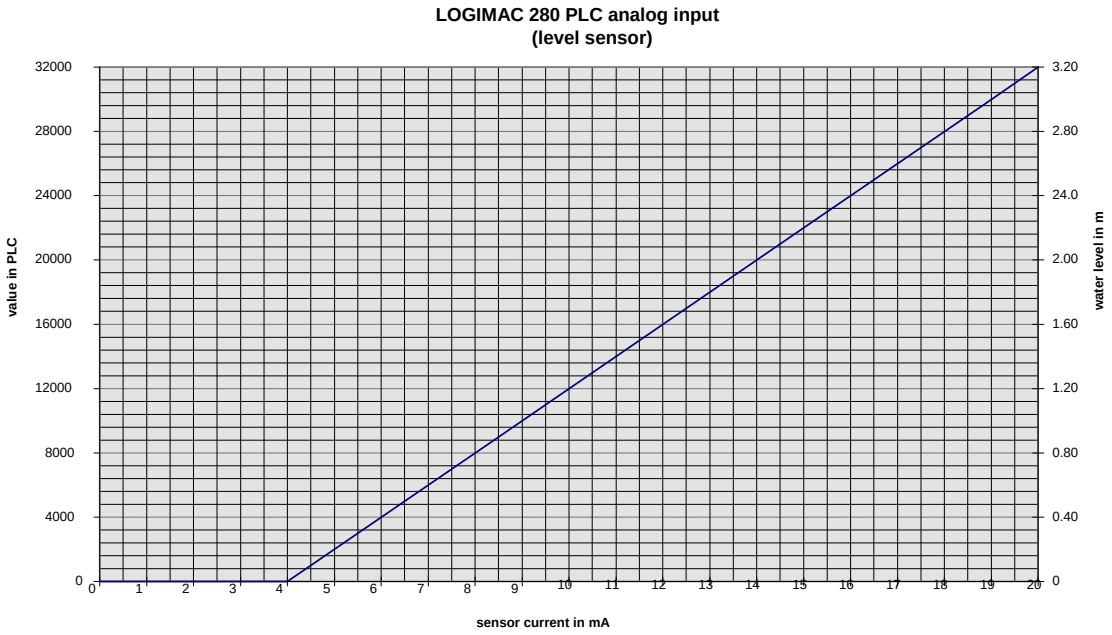
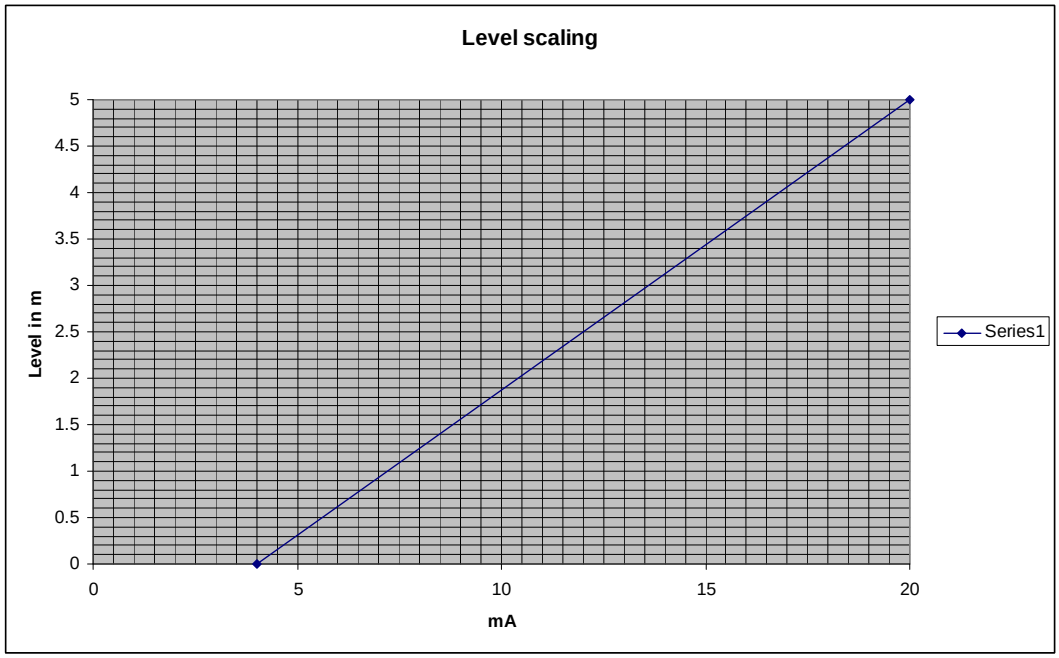


FIG. 2 ANALOG INPUT SCALING (LEVEL)

The scaling will be automatically changed by PLC if an operator provides different values of ranges using the operator interface (exemple for 0-5m)



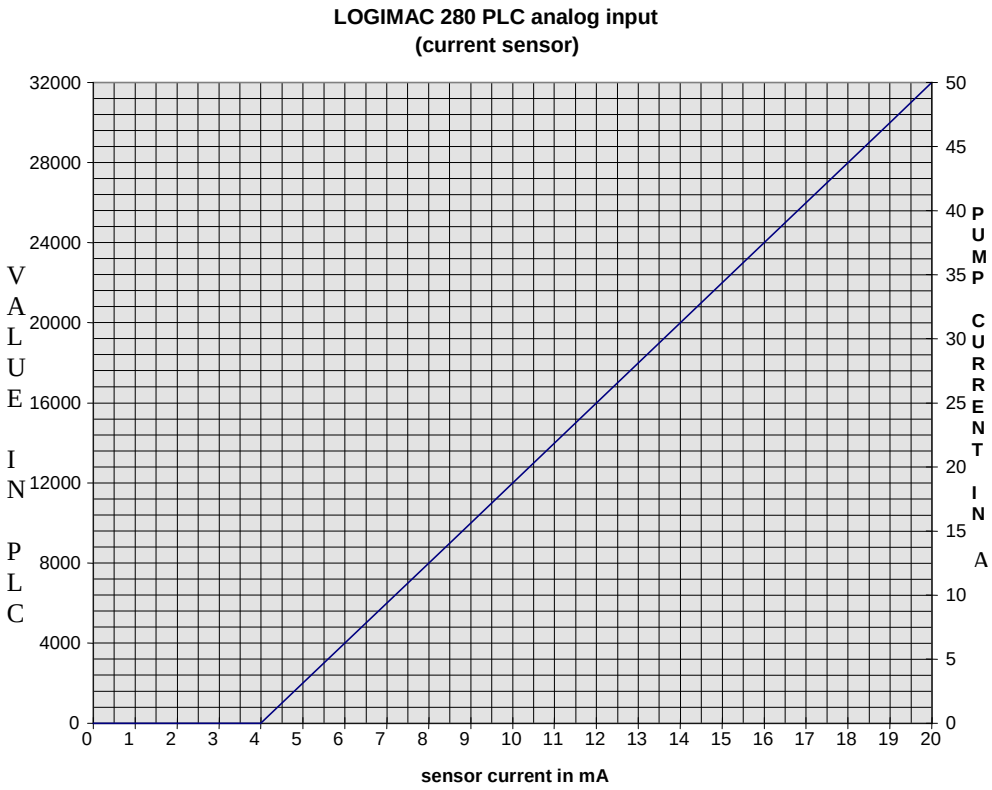
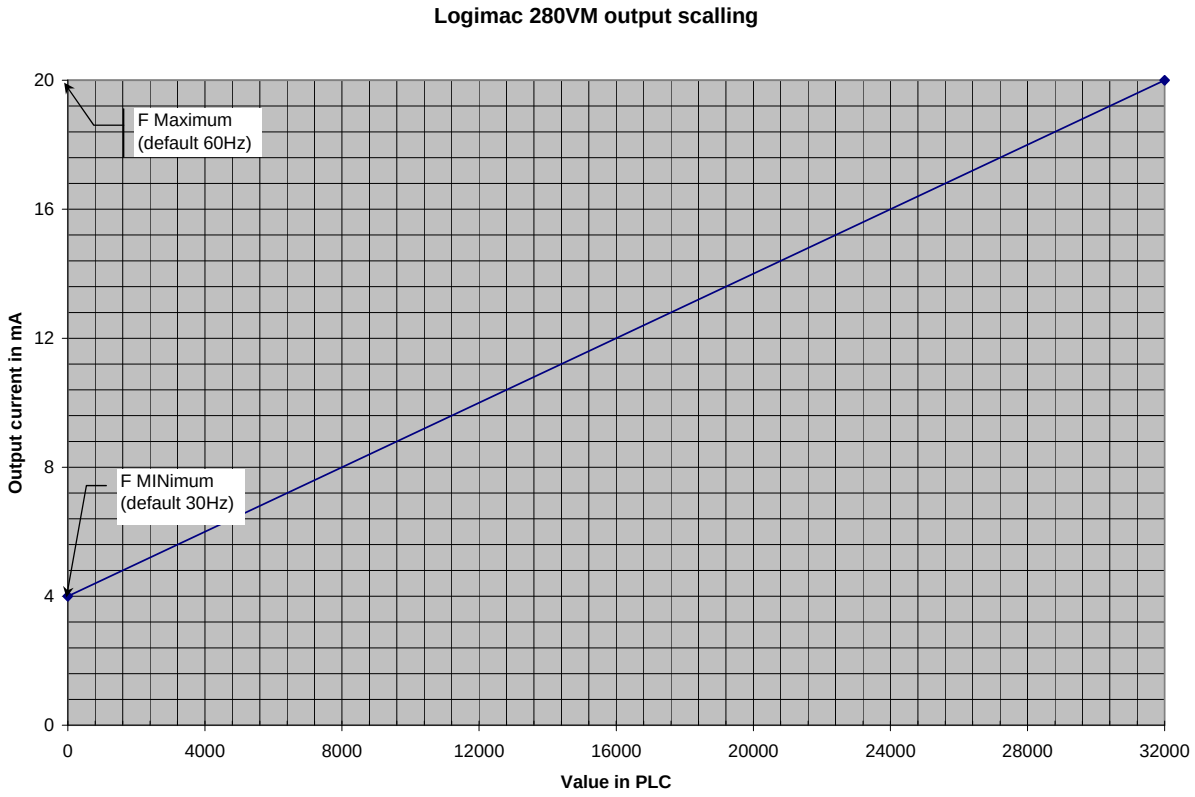


FIG.3

ANALOG INPUT SCALING (CURRENT)

If the inputs of pumps' currents are not used, no changes are required in default values of ranges. The PLC will treat these inputs as a zero signal.



Applicable for controls using the Logimac280VFD only

4.3 STARTING PUMP CHOICE

The control system allows the operation of either one or two pumps in parallel but prevents simultaneous start of two pumps.

In automatic mode a choice of the pump to start is done by the PLC program following the conditions specified below:

P1 PUMP is chosen to start as a **duty pump** if :

- The start conditions are reached (water level is higher than START 1 or high level float is active) and
- P1 pump is operational (no faults) and
- the alternate mode is not chosen or P2 pump is faulty, or
- the alternate mode is chosen but P2 pump operation had been memorized or P1 operation had not been memorizing

P2 PUMP is chosen to start as a **duty pump** if :

- The start conditions are reached (water level is higher than START 1 or high level float is active) and
- P2 pump is operational (no faults), and
- the P1 pump is faulty, or
- the alternate mode is chosen and the P1 cycle of operation had been memorized,

P1 PUMP is chosen to start as a **standby pump** if :

- The parallel operation conditions are reached (water level is higher than START 2 level or high level float is active) and
- P1 pump is operational (no faults), and
- M2 contactor is closed

P2 PUMP is chosen to start as a **standby pump** if :

- The parallel operation conditions are reached (water level is higher than START 2 level or high level float is active) and
- P2 pump is operational (no faults) , and
- M1 contactor is closed

To start the pump, either the start conditions or parallel conditions should be kept during at least **10-second** period calling ***START DELAY.*** The default value of 10 seconds can be changed by operator (see *TIME DELAY CHANGE* in chapter 5.2)

If one of pumps is stopped (for whatever reason) the BLOCKING DELAY will be activated. Neither the pump P1 or P2 can start during this period (two pumps will be prevented to start). If two pumps are running and one of them stops this delay will not have effect on running pump.
The default value of the BLOCKING DELAY are 15 s and can be adjusted by operator using operator interface for each pump separately (see *TIME DELAY CHANGE* in chapter 5.2).

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4.4 CONTACTOR OPERATION

In automatic mode the M1 contactor (or the M2 contactor) will close following the closing signal from R1 (or R2) interface relay after ***START DELAY*** as specified in previous chapter.
Reception of the contactor closing confirmation by PLC will be indicated by turning on the respective diode LED labeled **RUN P1** or **RUN P2** on the alarm annunciator (see appendices 1 for annunciator details).

NOTE: ***Closing fault***: If PLC does not receive a confirmation of the contactor closing (see M1 or M2 contact as PLC inputs) during the 10-second period following the closing order (R1 or R2 relay contact closing), the closing order will be removed and the alarm will be signaled.

In automatic mode, if stop conditions are reached, the running pump contactor will open. If two pumps are running, M1 contactor opens first (on STOP 1) and M2 contactor follows (on STOP2).

Each contactor can be open or closed manually, using a mode selector MAN-OFF-AUTO (MAN**-OFF** positions).

Either during manual or automatic operation the contactor opens automatically on fault conditions of the respective pump.

4.5 ALARMS : Memorizing, indication, acknowledge, reset.

The following alarms can be stored in the operator interface memory:

Pumps` alarms, for each pump:

- Overload
- Contactor closing fault
- Leakage
- High temperature
- Low current
- High current
- No automatic mode (warning)

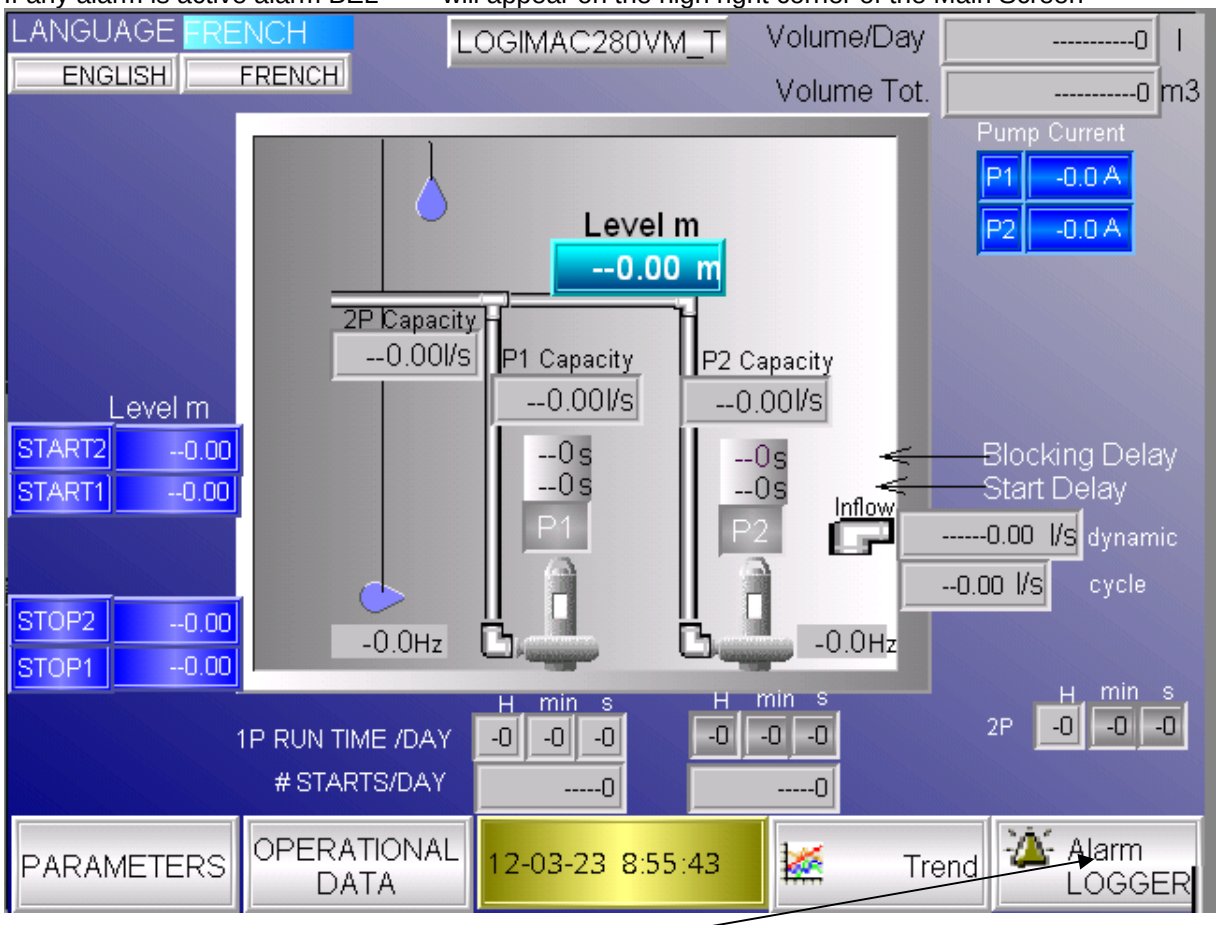
Well alarms:

- High Level
- Low Level
- Overflow

Supply alarm

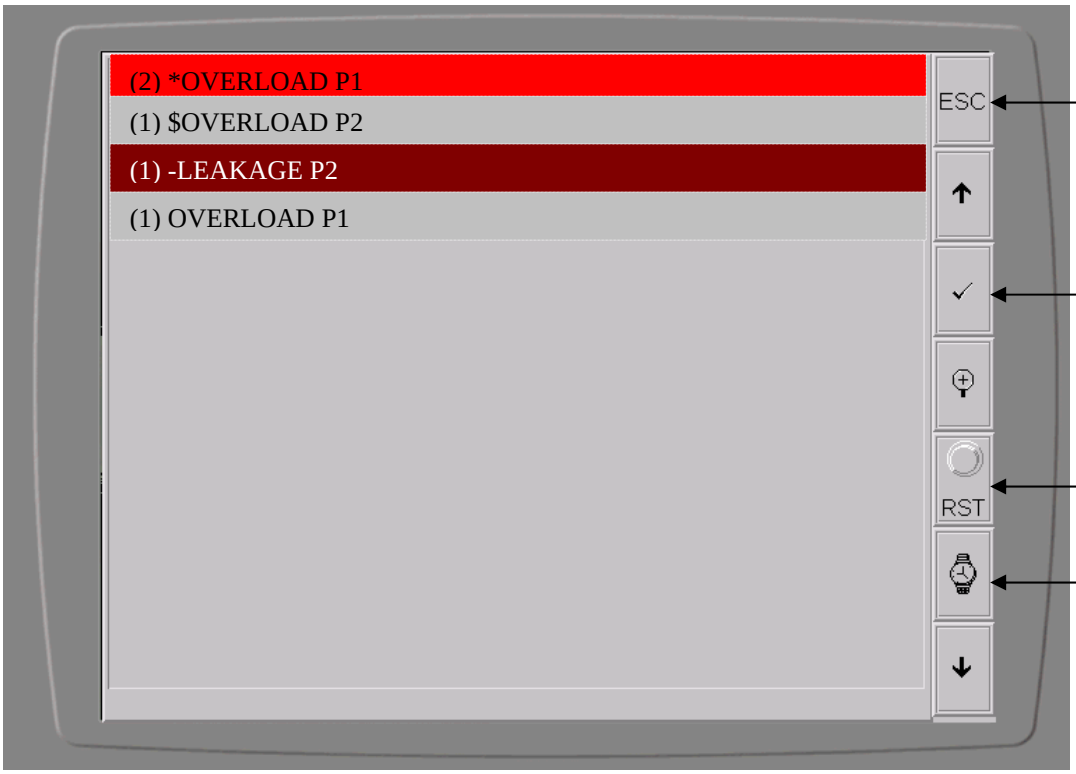
- Power failure

If any alarm is active alarm BEL  will appear on the high right corner of the Main Screen



Touch Alarm LOGGER to go to the alarm page

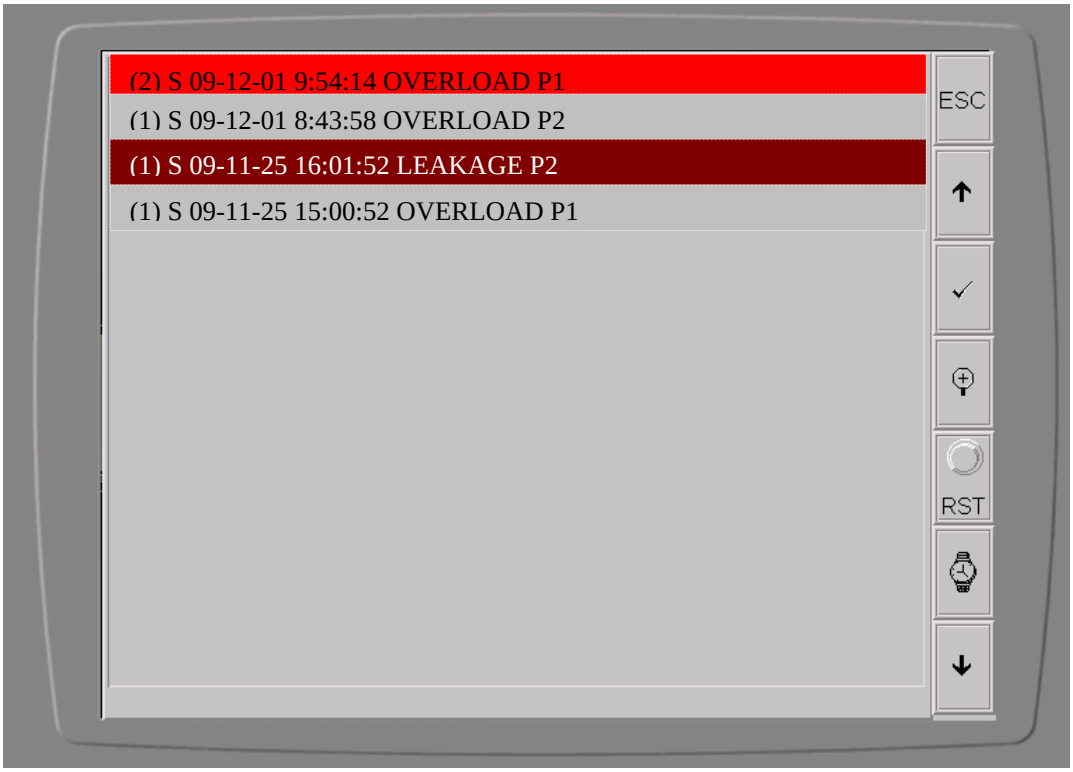
ALARM PAGE



Prefix Legend:
(1) - Number of alarm's occurrences before acknowledge
* - Active alarm, no acknowledged
$ - Alarm no active, no acknowledged
\- - Active alarm, but acknowledged
Void- alarm no active & acknowledged

For alarm acknowledge in operator interface, touch the alarm description first, then the button with check mark ✓.
For alarm acknowledge/RESET in PLC, correct the fault first and then touch the RST button (once for acknowledge and twice for RESET). Using the RESET P.B connected to the input 1 of the PLC will do the same job.

To see the time of the alarm occurrences and acknowledge touch the button with clock



By touching consecutively the button with clock , you can see different times with prefix **S**, **E**, **A**
Where:
S - Time of alarm activation
E - Time of alarm disappearance
A - Time of alarm acknowledge

4.5.1. P1 or P2 pump OVERLOAD

On the overload fault, the respective pump breaker opens. Auxiliary contacts of breakers are used as the overload signal for PLC inputs (OL1or B1, OL2 or B2).
If one of contacts is closed (OL1 or OL2), the corresponding contactor closing signal will be removed (see R1 or R2 relay) and the OVERLOAD alarm will be memorized in PLC & operator interface memories.

This alarm will be held, even if the fault conditions disappear. The contactor of the pump in fault will open automatically and cannot be closed without an operator intervention.

Reset the circuit after the fault correction: push the RESET push-button once for **acknowledge** and twice for **reset,** or use RST P.B. on the operator interface alarms' page.

4.5.2. M1 or M2 contactor CLOSING FAULT

If the PLC does not receive the confirmation of the contactor closing (see M1 or M2 contact as PLC inputs) during the 10-second period following the closing order (R1 or R2 relay contact closing), the closing order will be removed and the alarm M1/M2 contactor closing fault will be registered in PLC and operator interface memories.
This alarm will be held, even if the fault conditions disappear.
Reset the circuit after the fault correction: push the RESET push-button once for **acknowledge** and twice for **reset,** or use RST P.B. on the operator interface alarms' page.

4.5.3. ALARM: WATER LEAKAGE OF P1/ P2 PUMP

The faults detection will be done by the sensors attached to Mini CAS II units of ITT Flygt. The interface relay of this unit (**R6** or **R8**) operates if water is detected in the corresponding pump. The contact of this relay is connected to PLC input to provide the information.

If one of these contacts is closed, the corresponding contactor closing signal will be removed (see R1 or R2 relay) and the alarm LEAKAGE will be memorized in PLC & operator interface memories.

This alarm will be held, even if the fault conditions disappear. The contactor of the pump in fault will open automatically and cannot be closed without an operator intervention.
Reset the circuit after the fault correction: push the RESET push-button once for **acknowledge** and twice for **reset,** or use RST P.B. on the operator interface alarms' page.

4.5.4. ALARM: HIGH TEMPERATURE OF P1/ P2 PUMP

The faults detection will be done by the sensors attached to Mini CAS II units of Flygt. The interface relay of this unit (**R5** or **R7**) operates if a temperature of pump goes higher than sensor adjustment in the corresponding pump. The contact of this relay is connected to PLC input to supply the information.

If one of these contacts is closed, the corresponding contactor closing signal will be removed (see R1 or R2 relay) and the alarm HIGH TEMPERATURE will be memorized in PLC & operator interface memories.

This alarm will be held, even if the fault conditions disappear. The contactor of the pump in fault will open automatically and cannot be closed without an operator intervention.

Reset the circuit after the fault correction by pushing MiniCAS RESET first, then, push the RESET push-button once for **acknowledge** and twice for **reset,** or use RST P.B. on the operator interface alarms' page.

4.5.5. ALARM: HIGH WATER LEVEL

The fault detection is done by FLH float or by analog level sensor.
When float is tilted its normally open contact (NO) (or ISRH interface relay) closes. That contact is connected to the PLC input 11.
The **High level** alarm is also activated when the level reaches the High level value adjusted using operator interface.
In both cases R14 relay will operate (its NO contact is available for a remote transmission of the **ALARM** signal). The common alarm will stay even if fault condition disappears.
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The **output 5** gives a **High Leve**l signal. This output is energized on High Level float tilted. This output can be used to connect the interposing relay (with 120V AC coil) if a dry contact is needed for remote High Level alarm indication.
Reset the circuit after the fault correction: push the RESET push-button once for **acknowledge** and twice for **reset,** or use RST P.B. on the operator interface alarms' page.

4.5.6. ALARM: LOW LEVEL

The faults detection is done by FLL float or by analog level sensor.
The normally closed contact of the float (or normally open contact (NO) of ISRL interface relay) is connected to the PLC input.
If this contact is closed, a LOW LEVEL alarm will be memorized in PLC memory and will be indicated by the flashing LED diode (**LOW LEVEL**) on the alarm annunciator.
This alarm will be registered in PLC & operator interface memories.
The **Low level** alarm is also activated when the level reaches the Low level value adjusted using operator interface.
In both cases R14 relay will operate (its NO contact is available for a remote transmission of the **ALARM** signal). The common alarm will stay even if fault condition disappears. Reset the circuit after the fault correction: push the RESET push-button once for **acknowledge** and twice for **reset,** or use RST P.B. on the operator interface alarms' page.

The contactors of the pumps will open automatically but can be closed if fault conditions disappear.

4.5.7. ALARM: POWER FAILURE

The faults detection will be done by the power failure detector (PFD) connected to three phases of the power entrance. The PFD operates on phase or power failure. Its NC contact is open if three phases are present and voltage value is between adjusted limits. On fault this contact will close.

If this contact is closed, the contactor closing signals will be removed (see R1 and R2 relays) and the alarm POWER FAILURE will be will be memorized in PLC & operator interface memories.

This alarm will disappear if fault conditions disappear.
On fault the contactors will open automatically but can be closed following start sequence if the utility power is back to normal.

4.5.8. ALARM: P1/P2 PUMP LOW CURRENT

If the pump current analog inputs are used these alarms can be available. The limit values for these alarms can be provided by an operator using the operator interface (see chapter 5.2 for details). The default values are established as zero (0) Amps. An operator can change these values for the LOWEST POSSIBLE CURRENT established during pump's running test.

If the pump current value is lower than established lowest value for respective pump, LOW CURRENT OF P1 (or P2) PUMP alarm will be registered in PLC & operator interface memories.. The 30-seconde delay (by default) prevents the activation of the alarm during transient conditions.
This alarm will be held, even if the fault conditions disappear. The contactor of the pump in fault will open automatically and cannot be closed without an operator intervention.

Reset the circuit after the fault correction: push the RESET push-button once for **acknowledge** and twice for **reset,** or use RST P.B. on the operator interface alarms' page.

4.5.9. ALARM: P1/P2 PUMP HIGH CURRENT

If pump current analog inputs are used these alarms can be available. The limit values for these alarms can be provided by an operator using the operator interface (see chapter 5.2 for details). The default values are established on 35 Amps. An operator can change these values for the HIGHEST POSSIBLE CURRENT established during pump's running test.

If the pump current value I1 (or I2) is higher than established highest value for respective pump, the HIGH CURRENT OF P1 (or P2) PUMP alarm will be registered in PLC & operator interface memories. The 30-seconde delay (by default) prevents the activation of the alarm during transient conditions.
This alarm will be held, even if fault conditions disappear. The contactor of the pump in fault will open automatically and cannot be closed without an operator intervention.
Reset the circuit after the fault correction: push the RESET push-button once for **acknowledge** and twice for **reset,** or use RST P.B. on the operator interface alarms' page.

4.5.10. COMMON ALARM

All alarms described above will activate the COMMON ALARM OUTPUT with **R14** interface relay. The contacts of this relay are available to remote control or indication.

4.5.11. ALARM: PLC FAULT

If PLC is functioning correctly the output Q1 is activated. In case of internal PLC fault or external PLC supply fault the output Q1 will be not energized. Use the normally closed contact of the interposing relay R15 attached to this output for alarm transmission.

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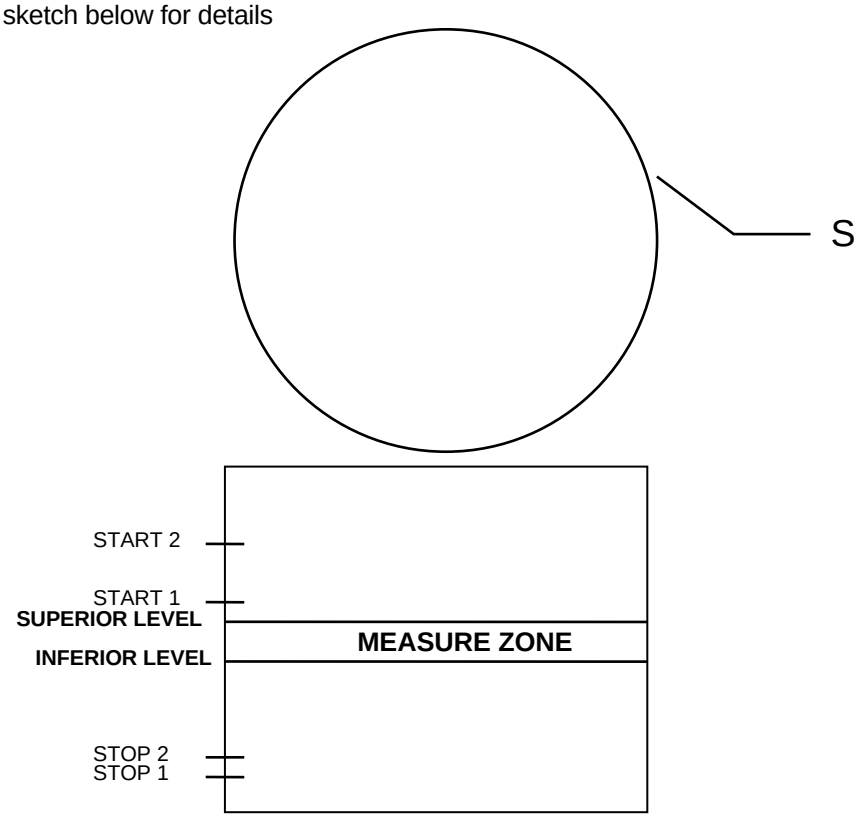
4.6FLUSHING ONCE A DAY SEQUENCE

The special sequence is programmed to do a flushing of a piping system once a day. It can be used either for a system designed for an operation of one pump only at the time (setting of # of pumps in PARAllel: 1) or for the system where two pumps are allowed in parallel operation (setting of # of pumps in PARAllel: 2).
The hour of flushing can be adjusted on the operator interface (see first screen under function key F2 **write**). The default value is 24h, which made this function disable.
Operator should set the hour of flushing (0 - 23h). If this hour is reached a START 1 level set value will be ignored. Two pumps will start if level START 2 is reached. As usual the start delay is applied between pump starts to prevent simultaneously start of two pumps. Two pumps will stop on STOP level. Once the flushing cycle finished the system return to the normal sequence.

4.7 PUMP CAPACITY CALCULATION (For L280CAP only)

The PLC is programmed to calculate the pump capacity using so-called Jacuzzi Jaeger method. The method requires a MEASURE ZONE (a volume bounded by two sump levels: **inferior level** and **superior level)** to be defined. The MEASURE ZONE should be chosen between last STOP level and first START.
In addition to these levels, the MEASURE ZONE section **area** (S) should be also defined. The default parameters are shown in the table 7 (next chapter). These two levels and area can be changed using the operator's interface (see next chapter for details). It is very important to input the data as precise as possible.
NOTE: If a section area of measure zone changes within the zone, recalculate the equivalent section for uniform zone based on constant zone volume.
See the sketch below for details



Pump capacity calculation is based on the average CYCLE INFLOW and on the time needed to pump the defined previously volume of the MEASURE ZONE out. The cycle inflow is measured and calculated for each pumping cycle during the rising liquid level in MEASURE ZONE.

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In addition the value of the DYNAMIC INFLOW is calculated every second by PLC. The dynamic inflow can be read on the operator interface screen. It can be considered as instantaneous value of the inflow.

NOTE: The Dynamic Inflow can be calculated also without the option of Pump Capacity Calculation (L280CAP) if the values of rated capacity & sump section area are inputted.

During each pumping cycle one of the following pump capacities will be calculated by PLC:

- P1 capacity (if only P1 pump pumps out all volume of the measure zone)
- P2 capacity (if only P2 pump pumps out all volume of the measure zone)
- 2P capacity (two pumps capacity - if two pumps pump out all volume of the measure zone)

The calculation results of the CYCLE INFLOW and PUMP'S CAPACITIES can be read on the operator's interface screen (see next chapter for details) and can be printed on the system printer for each pumping cycle (see printing option for details).
SYSTEME CALIBRATION
For proper operation the system should be properly calibrated.
The calibration consists to choose the initial values of pump capacity used by the system as reference values.
To make it done automatically proceed as follow:

- choose the period of the day with low inflow to have only one pump in operation at the time
- choose INFERIOR & SUPERIOR level of the MEASURE ZONE
- measure the area of the section of the MEASURE ZONE
- Enter all the parameters using operator interface : INFERIOR & SUPERIOR level in m (format xx.xx) AREA in square meters (format xx.xx)
- Pump the station to a level below the measure zone
- Enter the rated value of the pump capacity (if this value is not available, enter the random value different from that one you see on the operator interface screen)
- Put the pump functioning mode selectors in AUTO position
- wait to the end of pumping cycle; the entered previously RATED CAPACITY 1P **Cnom** will be completed by the real value of measured system REFERENCE CAPACITY **Cref**.
- If the values **Cnom** and **Cref**. differ more than 10% , repeat the last 4 steps by entering calculated **Cref** as **Cnom**.
- **To calibrate 2 pumps capacity calculation**: pump the station to a level below the measure zone and wait until the level increases to Start 1
- after the first pump starts, put the second pump in operation manually (pump Man-Off-Auto selector in Man position)
- Wait to the end of the pumping cycle (until the first pump stops) and than return the second pump to the automatic operation.
- The system is now calibrated: The values of **1P Cref** and **2P Cref** are used as reference values to determine the lowest and highest limits of a pump calculated capacities.

It is recommended to do this calibration once a year to keep the system calculation error within the lowest values possible.

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4.8 PUMPED VOLUME CALCULATION

For L280

A pumped volume is calculated continuously using the rated values of pump capacities (if they are inputted by operator) during the operation time. It is added continuously to the value of the pumped volume per day. Each day, at midnight, the daily pumped volume is added to the total pumped volume and the value of the daily pumped volume is set to zero (0). At any time, the pumped volumes (total and daily) can be read on the operator's interface (see next chapter for details)

For L280VFD mode unable

A pumped volume is calculated continuously using the rated values of pump capacities (if they are inputted by operator) during the operation time. The rated pump capacity is multiplied by the ratio of the actual pump speed to the rated speed (60Hz). The value of the pumped volume is added continuously to the value of the pumped volume per day. Each day, at midnight, the daily pumped volume is added to the total pumped volume and the value of the daily pumped volume is set to zero (0). At any time, the pumped volumes (total and daily) can be read on the operator's interface (see next chapter for details)

For L280CAP mode unable

A pumped volume is calculated using the recent, cycle calculated values of pump capacities and the operation time in each pumping cycle. It is calculated at the end of each cycle and the calculated value is added to the value of the pumped volume per day. Each day, at midnight, the daily pumped volume is added to the total pumped volume and the value of the daily pumped volume is set to zero (0). At any time, the pumped volumes (total and daily) can be read on the operator's interface (see next chapter for details)

At start up of the new station, default values are used to calculate a pumped volume. These default values are based on the value of the RATED CAPACITY. The RATED CAPACITY default value=0 so this calculation is disable . To do the calibration & unable the calculation, an operator should input at least a rated capacity of one pump **1P Cnom** > 0 (see next chapter for details).

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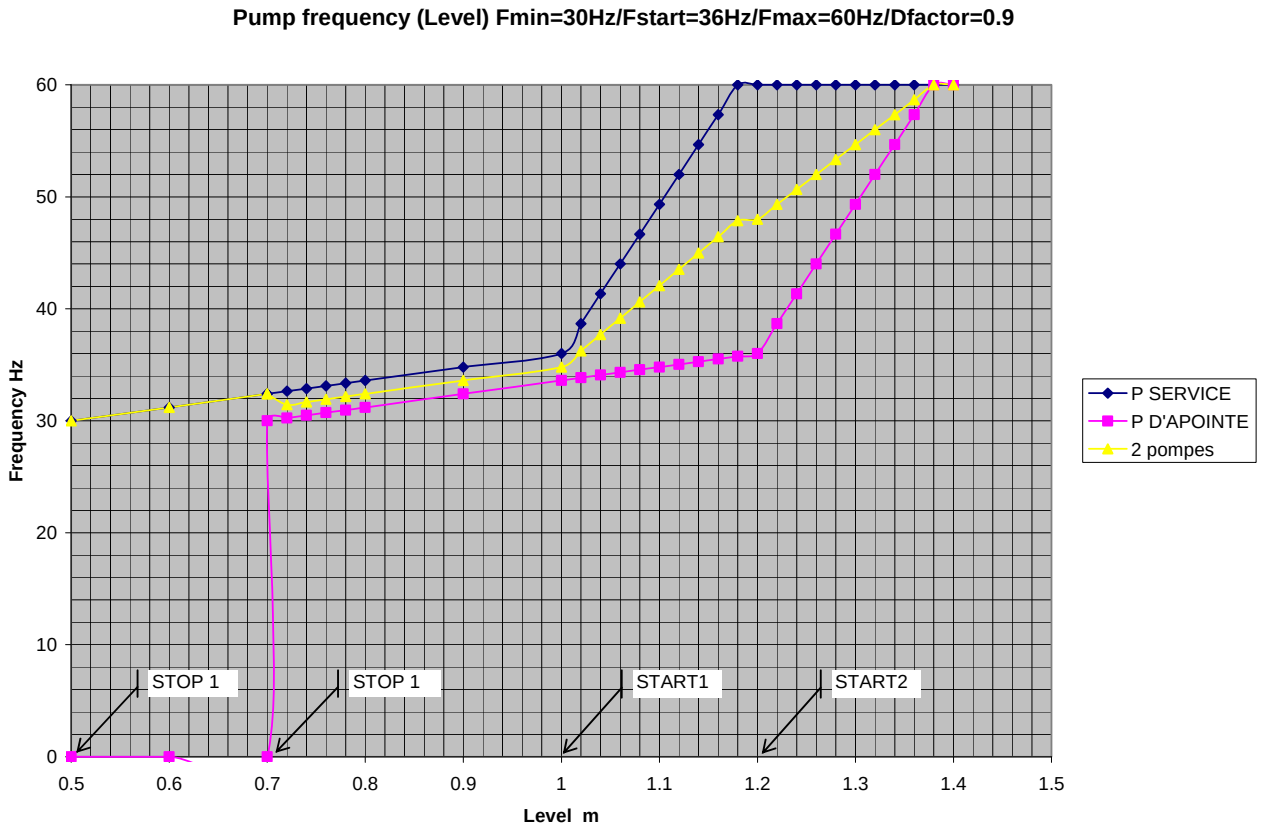
4.9 VFD CONTROL OPERATION **L280VFD** option

For the projects with a Variable **F**requency **D**rive (VFD) when the pump speed has to be control following the level changes, the **L280VFD** mode can be unable.
Once this option unable Logimac 280 will be able to give 4-20 mA signals to control pumps' VFDs.
See the figure below for parameters required to operate this control.



The required parameters are:

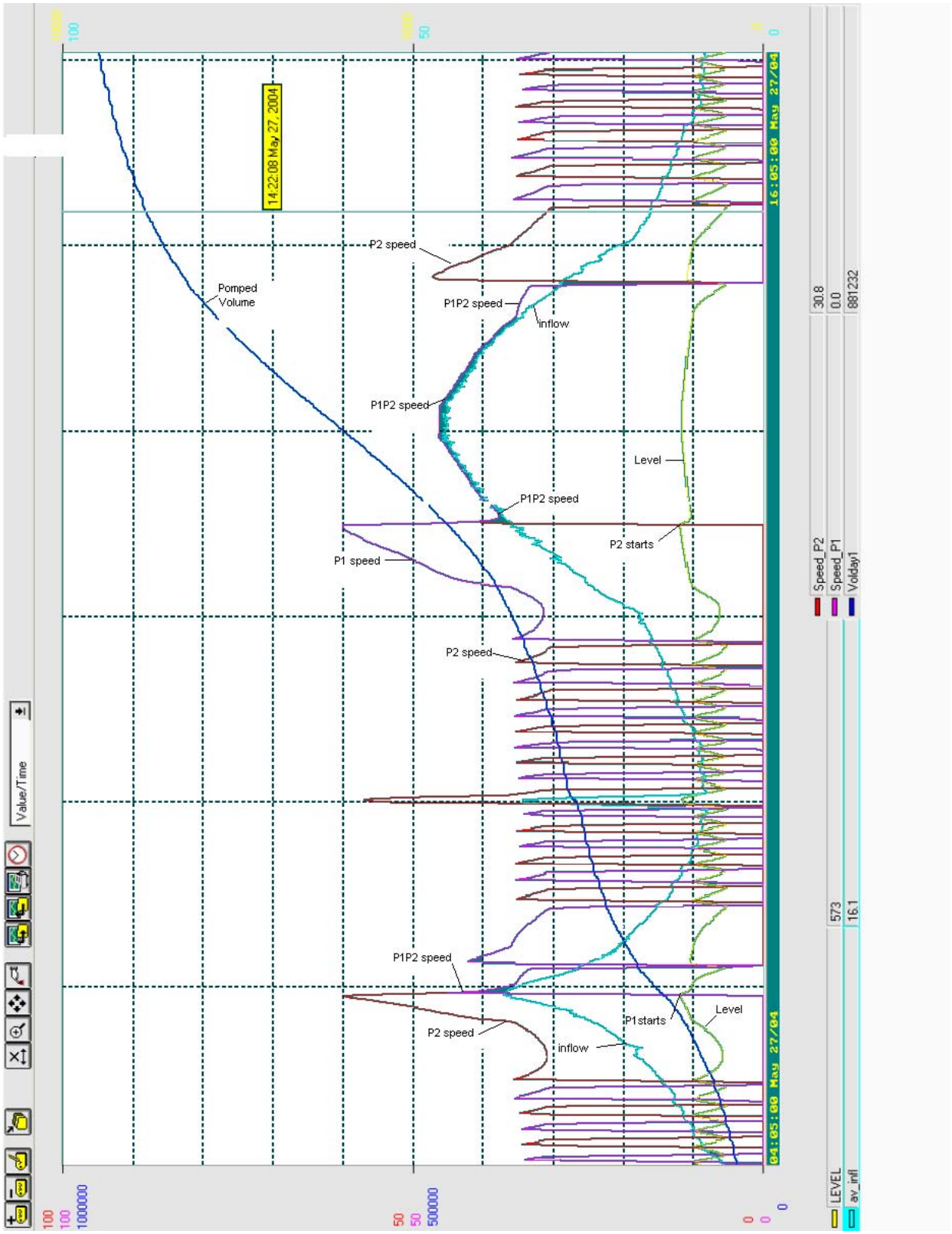
- **F min** (Minimum Frequency) – has to be the same as set in VFD. It corresponds to 4 mA VFD speed input signal.
- **F start** (Frequency at start level)
- **F max** (maximum Frequency – usually 60Hz) – has to be the same as set in VFD. It corresponds to 20mA VFD speed input signal
- **Dfactor** (the ratio of START 2 - START1) saying how fast the maximum frequency has to be reach (range 0.1—1.0)

(example **Dfactor** = 0.9 means that the leading pump maximum frequency will be reached at the level 1.18 m as a result of START1+ **Dfactor** *(START 2- START 1)

All this parameters are adjustable by operator using operator interface.
Note: The minimum speed **Fmin** should not be lower than 30Hz.

Control functioning:
If START 1 level (100cm) is reached the leading pump will start with the speed corresponding to **Fstart (36Hz).**
If the level decreases with pumping the pump speed will decrease until **Fmin** at STOP 1 level. In that point the pump stops.
If the level increases with leading pump functioning , its speed will increase linearly up to **Fmax** (60Hz) reached at the level = START 1 + Dfactor *(START2 – START1)
= 1.00+ 0.9*(1.20-1.00)=1.18m
Once this level reaches the leading pumps will be running at rated speed.

If the level still increases and reaches the START 2 level, the lagging pump will start. The speed pattern of the lagging pump is the same as the leading pump so theoretically the lagging pump speed will be **Fstart** (36Hz) but the system recalculates the both values to have the same speed for both pumps keeping the same total capacity. So the speed of 2 pumps working together will be: (SPEED lead+ SPEED lag)/2 = (60+36)/2=48 Hz.
If the level still increase the lag pump theoretical speed (SPEED lag) will increase linearly up to **Fmax** (60Hz) reached at level = START 2 + Dfactor *(START2 – START1) = 1.20+ 0.9*(1.20-1.00)=1.38m.
The system will recalculate the same speed for both pumps (SPEED lead+ SPEED lag)/2.
The same pattern will be follow if the level decreases down to STOP 2 level when the lag pump will stop.
After the lag pump stops and the level still deceases the lead pump speed will decrease linearly until **Fmin** at STOP 1 level when the pump stop.
NOTE:If high level alarm is reached the pumps speed will run with full speed corresponding to Fmax adjusted (usually 60Hz)



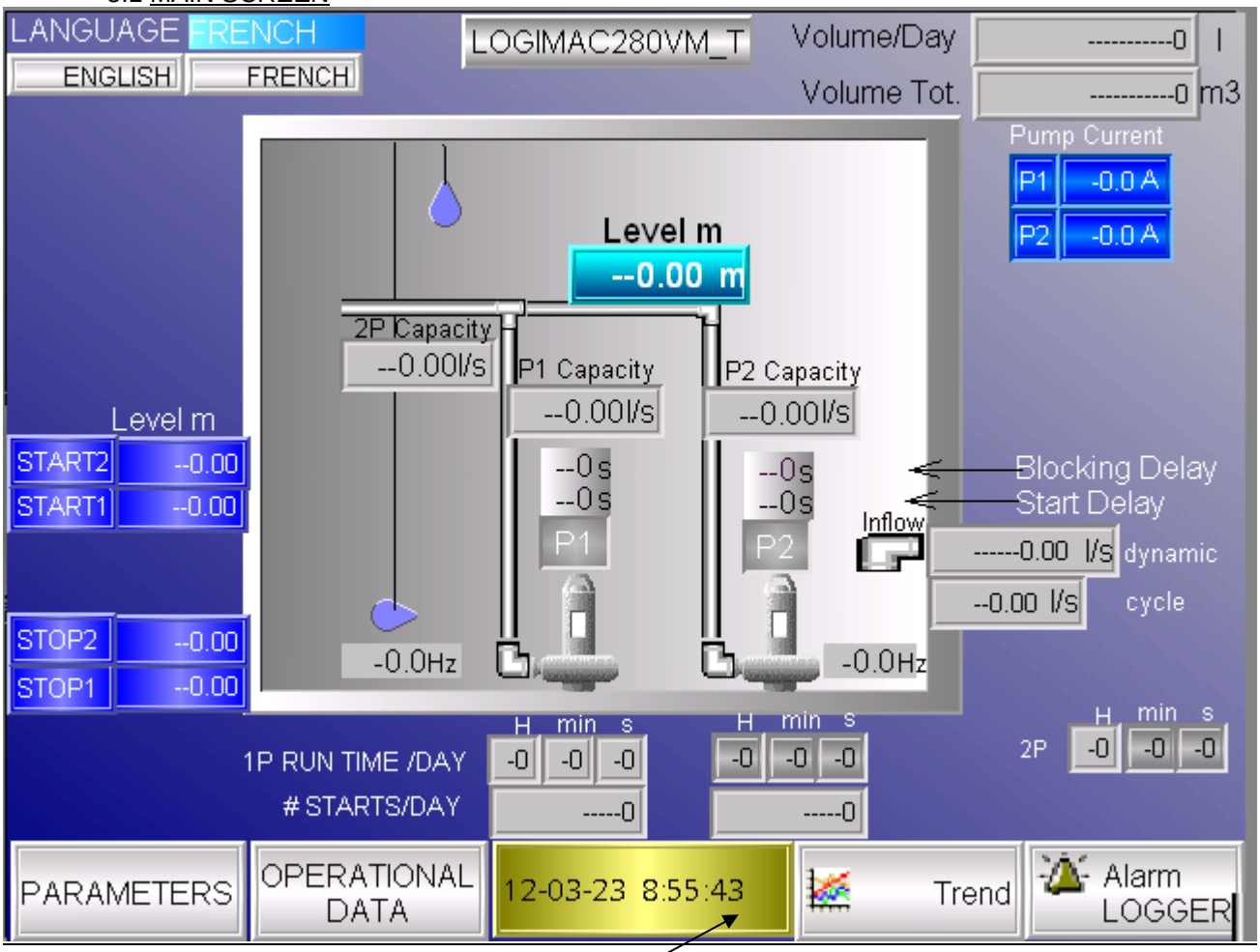
Exemple of Trend of VFD duplex pump control . Pumps capacity 35l/s; START1=100c; START2-120cm; Inflow varies from 5-46l/s

5. OPERATOR INTERFACE PROGRAM DESCRIPTION

Using the operator interface, an operator can :

- read or change PLC current date & time
- read the parameters and data stored in the PLC data registers
- write/change the system operating parameters (password protected)
- read the alarm register in order of the occurrence
- monitor the alarms
- see historic values: TRENDS
- reset all parameters to their default values (cold start)

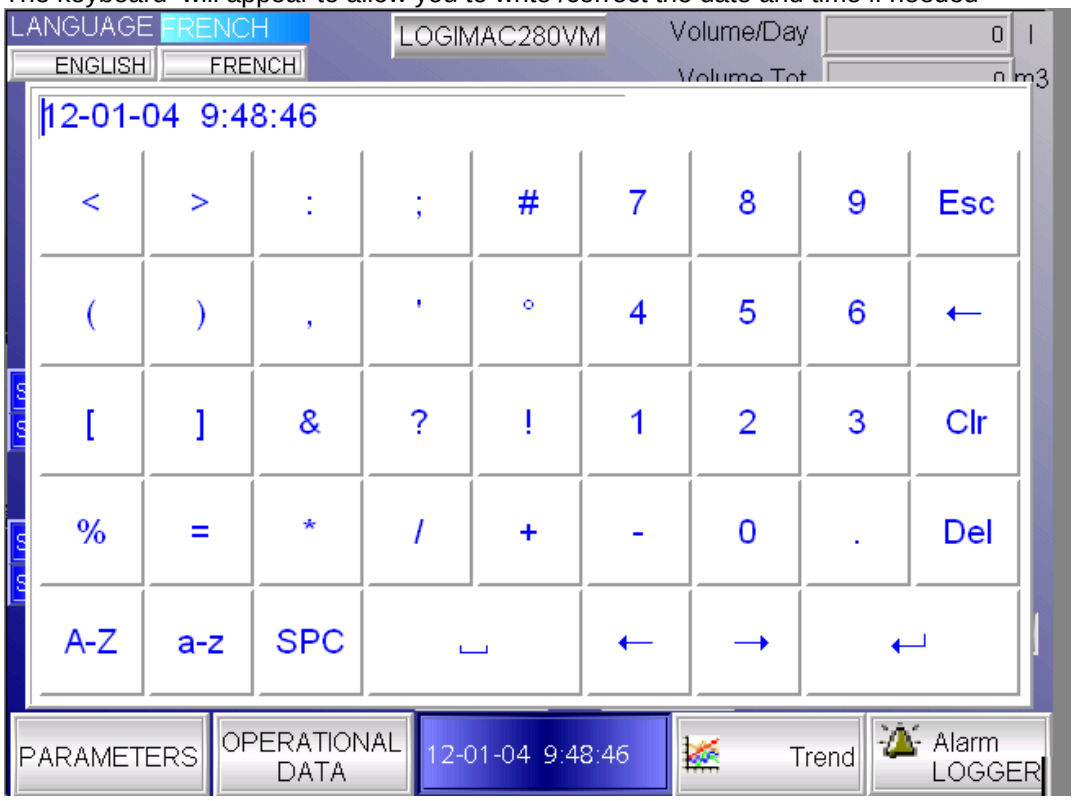
5.1 MAIN SCREEN



To change the date or time touch the digital clock

.

The keyboard will appear to allow you to write /correct the date and time if needed



Correct the date and time keeping the same format: **yy-mm-dd hh:mm:ss** for 24hours system

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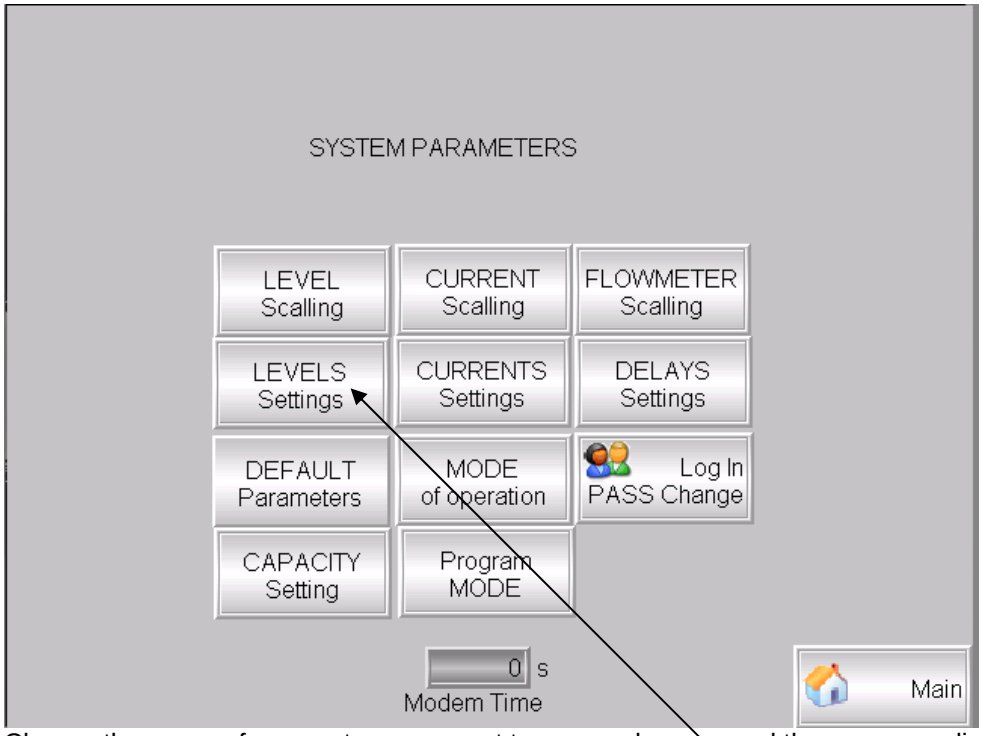
5.2. PARAMETERS' SCREENS

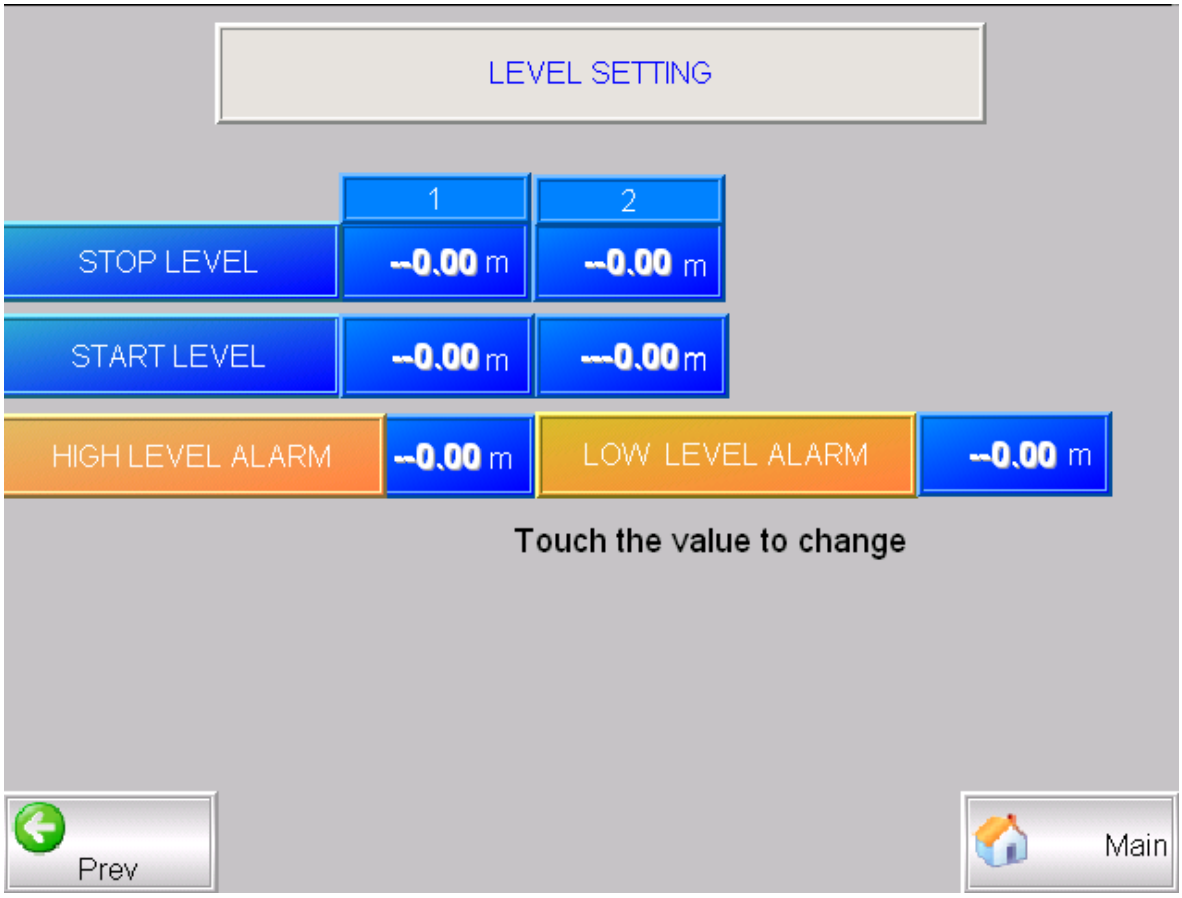
Some operational parameters are shown on the main screen. They are read only values.
To change them, touch PARAMETERS. This action is protected by PASWORD so the keyboard to write the password will appear.

Write password (default is 9), and touch ☐ and the screen of the parameter group will appear:



Choose the group of parameters you want to see or change and the corresponding screen will appear

.



Touch the value you want to change. The keyboard will appear:

Write the value and touch
Proceed with other parameter or parameters' group

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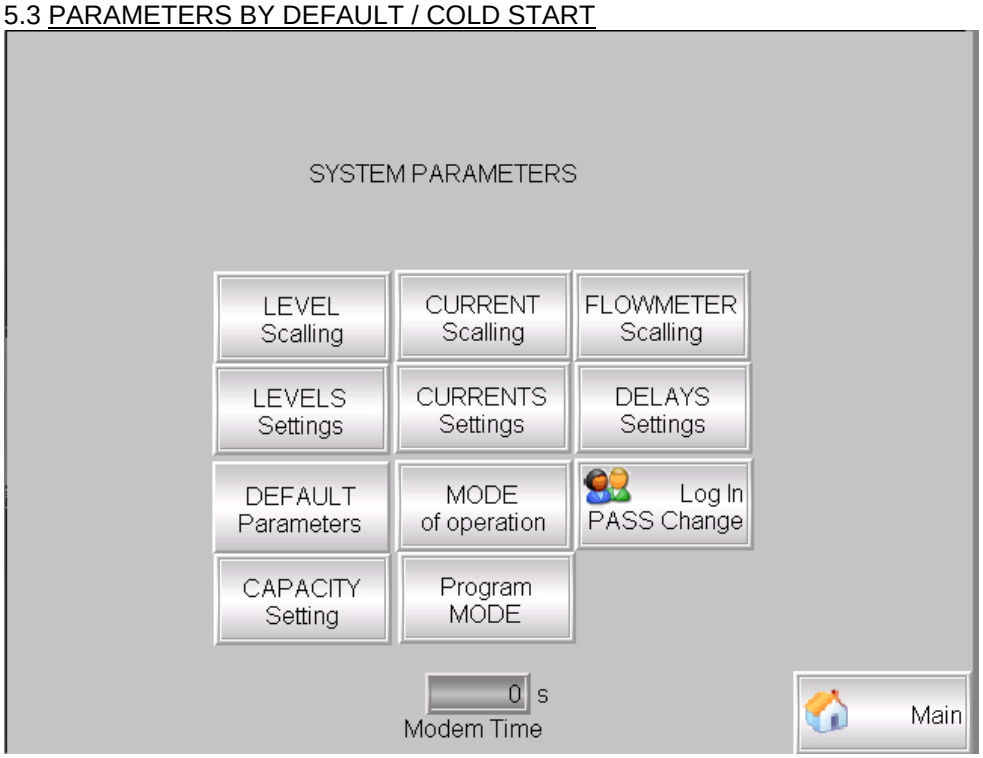
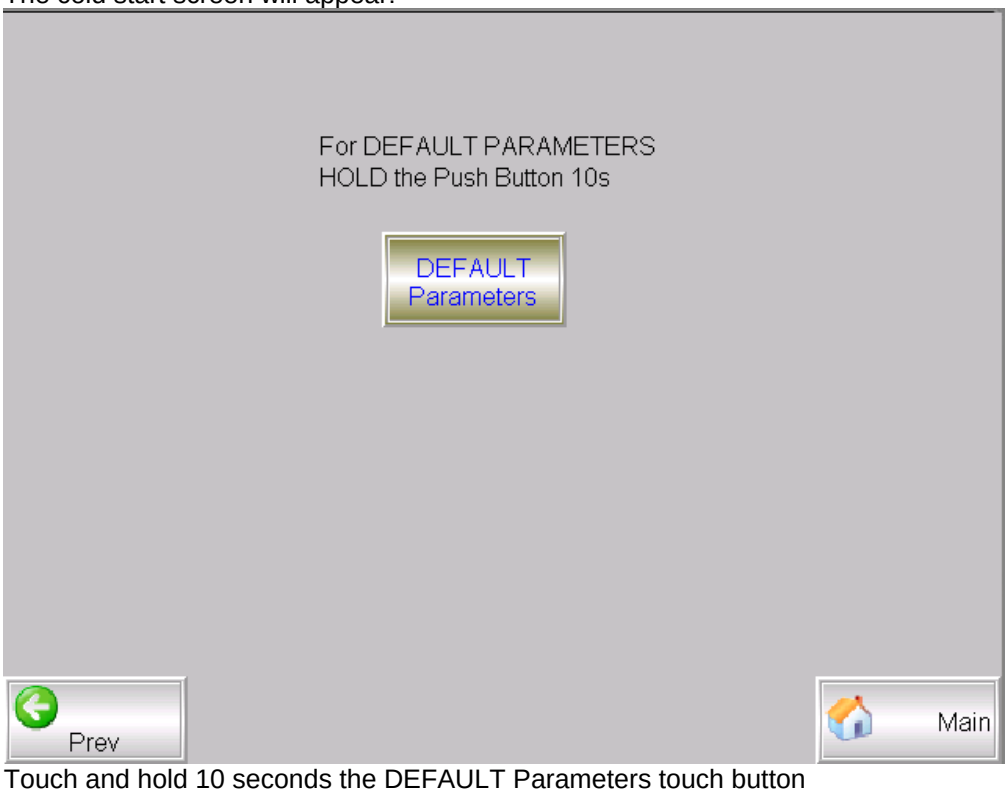
5.3 PARAMETERS BY DEFAULT / COLD START



Touch DEFAULT Parameters to go back to the all initial setting (as per table on page 10 - Cold Start)
The cold start screen will appear:



Touch and hold 10 seconds the DEFAULT Parameters touch button

.

The parameters will change as per table below

FUNCTION KEY/SCREEN	Parameters' group	PLC REGISTER	PARAMETER	INITIAL VALUE	NOTES
MAIN SCREEN		-	Language French English	English	
Parameters	Login PASS change	102	New password	9	
Parameters	MODE of operation	24 526	# of pumps inPARAllel (in simultaneous operation) Flush hour	2 24H	2- parallel operation 1-one pump only 24H-Flush disable
Parameters	DELAYS Settings	2	Start 1 delay	10 s	
Parameters	DELAYS Settings	5	Start 2 delay	10 s	
Parameters	DELAYS Settings	8	Blocking delay P1	15 s	
Parameters	DELAYS Settings	11	Blocking delay P2	15 s	
Parameters	DELAYS Settings	20	Alarm delay	5s	On Power up only
Parameters	DELAYS Settings	132	M1/M2 closing delay	10s	
Parameters	FLOWMETER Scaling	590/592	Flowmeter scaling	0-80l/s	
Parameters	LEVEL Scaling	70/72	Min/Max Level scaling	0-5.00 m	
Parameters	LEVEL Settings	74	Start 1 level	1.00 m	
Parameters	LEVEL Settings	75	Start 2 level	1.20 m	
Parameters	LEVEL Settings	76	Stop 1 level	0.50 m	
Parameters	LEVEL Settings	77	Stop 2 level	0.50 m	
Parameters	LEVEL Settings	107 106	High level alarm Low level alarm	2.00 m 0 m	
Parameters	CURRENT Scaling	96	P1 max. current	50 A	
Parameters	CURRENT Scaling	98	P1 max. current	50 A	
Parameters	CURRENT Settings	111 601	P1 high current alarm Delay	35 A 30s	
Parameters	CURRENT Settings	112 604	P2 high current alarm Delay	35 A 30s	
Parameters	CURRENT Settings	100 607	P1 low current alarm Delay	0 A 30s	
Parameters	CURRENT Settings	101 610	P2 low current alarm Delay	0 A 30s	
Parameters	MODE of Operation	-	ALTERNATE Mode Choice	ON	ON OFF toggle P1lead/P2lead
Parameters	CAPACITY Settings	94	M-zone Inferior Level	0.80m	L280CAP only
Parameters	CAPACITY Settings	95	M-zone superior Level	0.90m	L280CAP only
Parameters	CAPACITY Settings	1060	M-zone AREA	0 m^2	Required for inflow calculation
Parameters	CAPACITY Settings	113/2033	1P Cnom/Cref	0 l/s	Cnom-required for inflow calculation
Parameters	CAPACITY Settings	115/2035	2p Cnom/Cref	0 l/s	Cnom- required for inflow calculation
Parameters	CAPACITY Settings	114	Capacity histeresis	0 l/s	L280CAP only
Parameters	VFD's CTRL Setting	1503/1505/1504/1506	Frequency:Min/Start/Max/D	30/36/60/09 Hz	L280VFD only

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5.4 OPERATIONAL DATA Screen

On Main Screen touch OPERATIONAL DATA to go to the screen as below

The data on this screen are READ ONLY. This data can be reset only by authorized person. Level 2 password is required.

TABLE 5. PLC DATA REGISTER READING

FUNCTION KEY of OPERATOR INTERFACE	PLC REGISTER	PARAMETER	NOTES						
OPERATIONAL DATA	146, 143, 140	Runtime P1 TOTAL							
OPERATIONAL DATA	176, 173, 170	Runtime P1 /DAY							
OPERATIONAL DATA	155, 152, 149	Runtime P2 TOTAL							
OPERATIONAL DATA	185, 182, 179	Runtime P2 /DAY							
OPERATIONAL DATA	164, 161, 158	Runtime P12 TOTAL							
OPERATIONAL DATA	194, 191, 188	Runtime P12 /DAY							
OPERATIONAL DATA	217, 214, 211	Overflow runtime							
OPERATIONAL DATA	202	No. of starts P1							
OPERATIONAL DATA	205	No. of starts P2							
OPERATIONAL DATA	208	Hi level occurrences							
MAIN SCREEN	220	Overflow occurrences							

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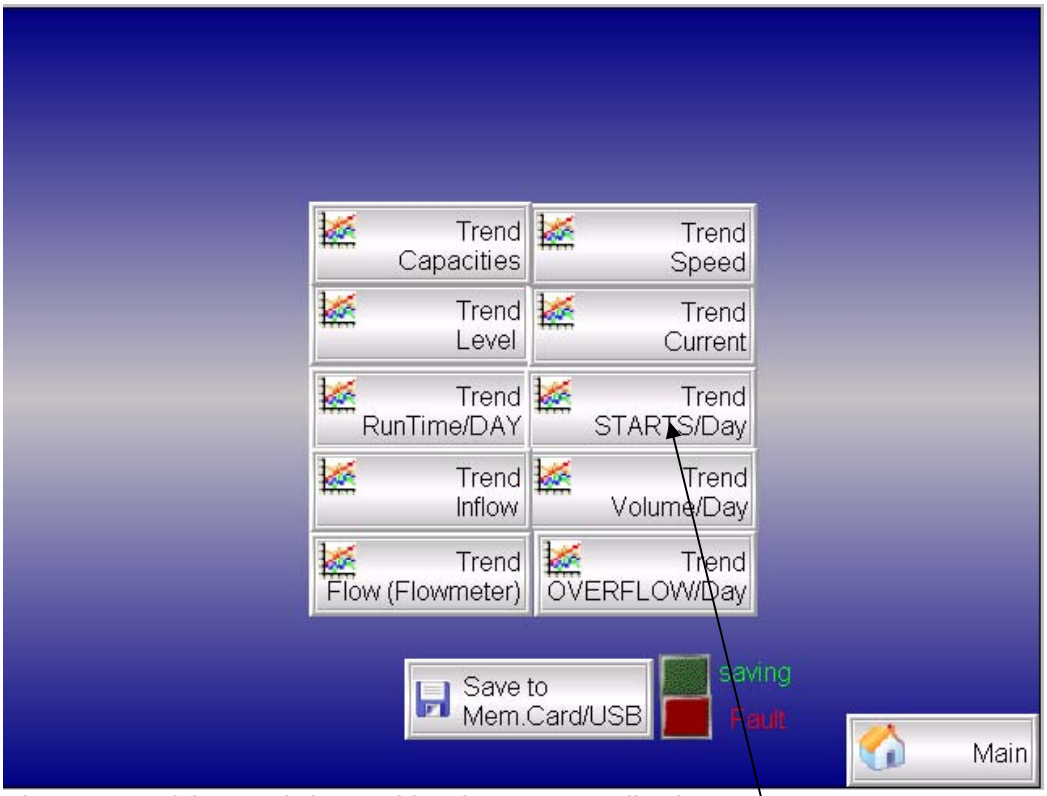
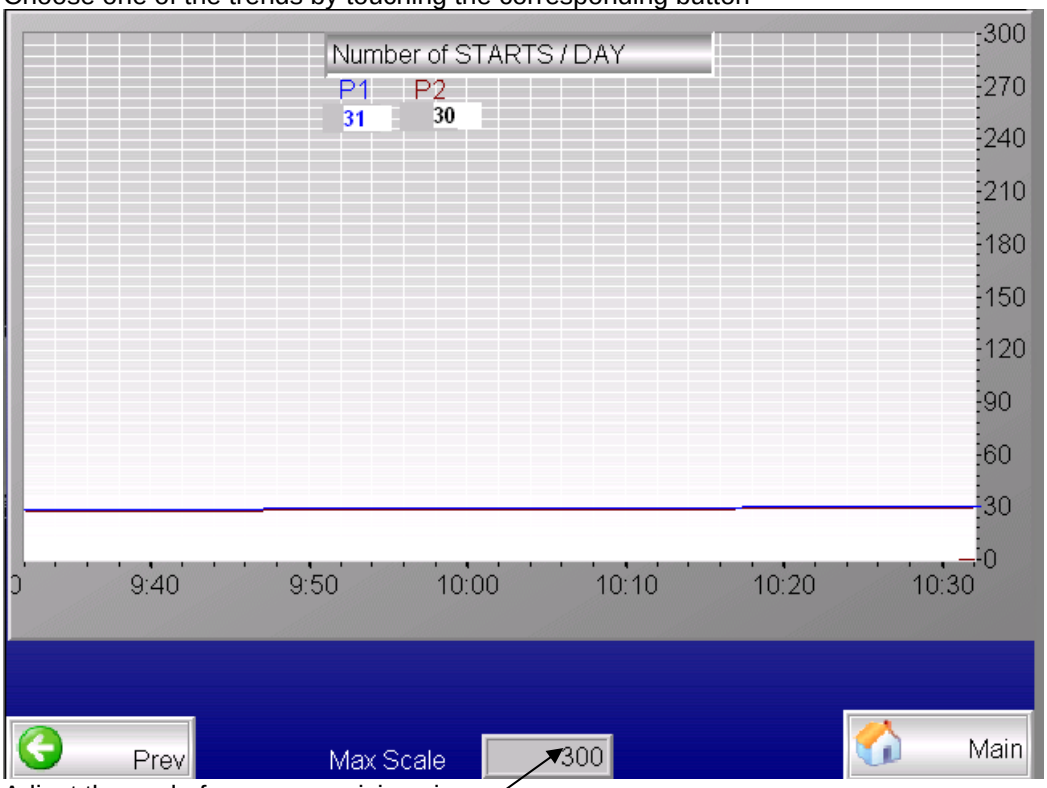
5.4 TRENDS' Screen

Touch the TRENDS button on the main screen to see the TRENDS' screen:

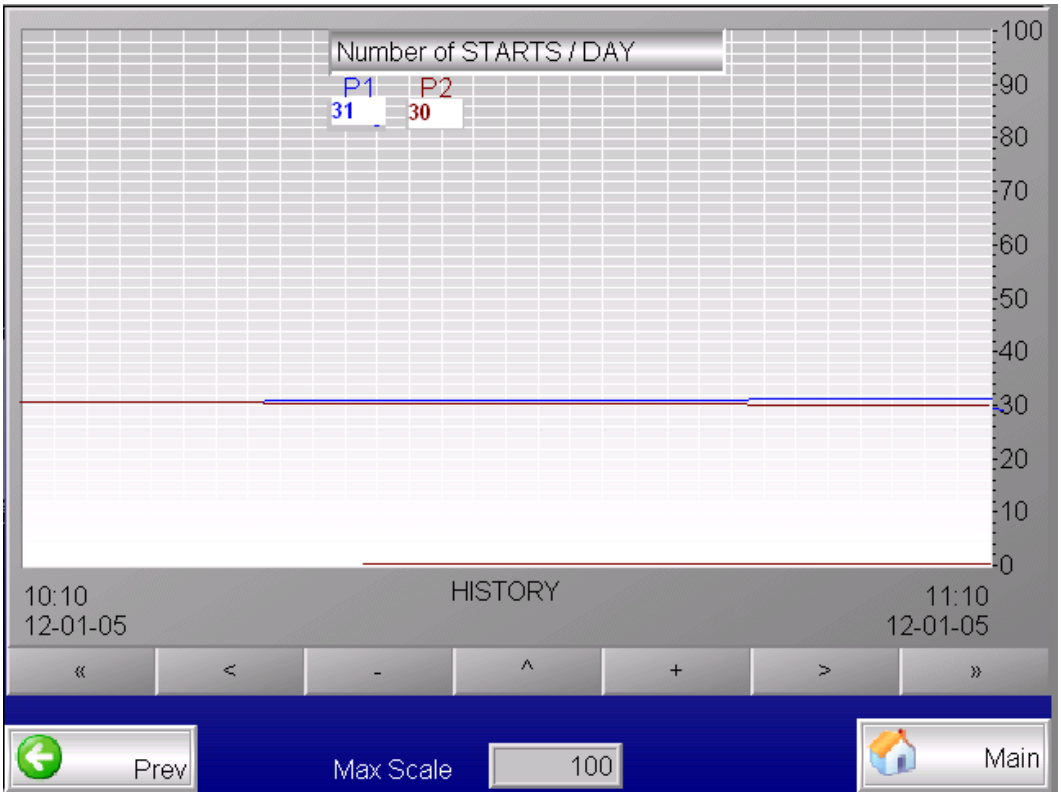


Choose one of the trends by touching the corresponding button



Adjust the scale for more precision view

Touch at the bottom of the trend to view historic data



Use the arrow buttons <> or << >> to go backward or forwards. Use + or – to change the time scale
Use ^ to go back to normal view.
All historic trends data are stored in operator interface memory as files with suffix **.SKV**
These files can be loaded to personal computer using the Ethernet connection. Use the cross Ethernet standard cable. Operator interface IP address is shown on power up of the unit (default is **192.168.1.1**)
On Internet Explorer page write: ftp://192.168.1.1 or just 192.168.1.1 to communicate with operator interface and see the trends files. The files **.SKV** are compatible with MS EXEL.
The format of the trend is as follow:
DDDD;TTTT;AAAA;BBBB;CCCC;DDDD;EEEE;FFFF
Where
DDDD- date in format yy-mm-dd
TTTT - time in format hh:mm:ss
AAAA –curve 1 data (sample: P1 starts number)
BBBB - curve 2 data (sample: P2 starts number)
CCCC – curve 3
DDDD – curve 4
EEEE – curve 5
FFFF – curve 6

The **alarm** file is also stored in the operator interface as **.SKV** file.
The file format is:
DDDD;TTTT;DDDD;TTTT;DDDD;TTTT;FFFFFFFFFF Where:
DDDD- date of alarm's activation yy-mm-dd
TTTT- time of alarm's activation hh:mm:ss
DDDD- date of alarm's deactivation yy-mm-dd
TTTT- time of alarm's deactivation hh:mm:ss
DDDD- date of alarm's acknowledging yy-mm-dd
TTTT- time of alarm's acknowledging hh:mm:ss
FFFFFFFFFF- alarm description

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EXTERNAL MEMORY CARD :

If memory card is inserted into operator interface the trends files can be transferred into for farther handling using the touch key SAVE TO MEM.CARD/USB.

!!! Do not TOUCH this key if the memory card is not inserted !!! It will lock the interface

The type of card recommended is KC64MF-201 from Cactus Industrial or SQF-P10S1-1G-P8C from Advantech

!!! You have to remove the operator interface supply before installing and removing the card!!!

Usage of USB key is recommended instead of memory card.
USB operation (inserting and removing) does not require the power removing from interface.

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