

DTDE 327

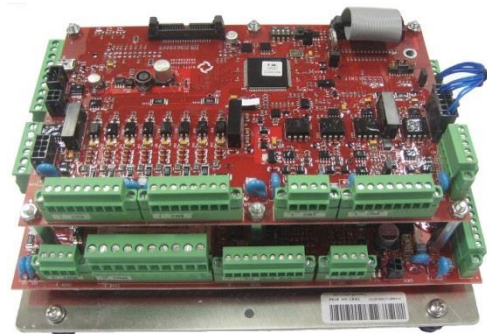


ECU 1000

Control functions and Local Operator Interface



ECU1000 cards



ECU1000 cabinets




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ECU 1000 Control functions and Local Operator Interface

Warning: 	<ul style="list-style-type: none"> • It is assumed that the installation, the setting, the commissioning, the maintenance and repair works are carried out by qualified personnel and checked by responsible Specialists. • The door of cabinet must be kept “closed” by the key (or equivalent tool). Operating the unit or working on the Electronics with the cabinet door “open” could cause personal injury and damage the equipment
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Warning: 	<p>The ECU1000 controls the actuator, it could control the HPU, it could drive generic electric, mechanic, pneumatic and hydraulic devices. To avoid unwanted movement of mechanic parts or leakage of pressurized fluids and risk injury of people and damage of equipment and ambient, any mechanic, electric, hydraulic and pneumatic device controlled by the ECU1000 device should be placed in safe condition before executing any installation, commissioning or maintenance operation (see relevant instruction manuals of actuator, HPU, etc.)</p>
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Warning: 	<p>If the device is located in hazardous area a “hot permit” must be obtained before opening the explosion proof enclosures. Moreover the area must be cleaned from explosive mixture since time keeper battery and residual capacitor charge could generate electrical spark and cause explosion. The installation must be carried out in accordance to the applicable Ex-d Standards regarding the electrical installations in hazardous areas and any other applicable national standard and rule.</p>
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Warning: 	<p>Refer to DTDE326 for the installation and maintenance instruction manual of the ECU1000 cabinet</p>
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REV.	DATE	PREPARED	APPROVED	NOTES
0	04/12/2012	M. Giuliani	A. Affaticati	Issue
1	14/03/2012	M. Giuliani	A. Affaticati	Mod. ESD par.
2	08/05/2013	M. Giuliani	A. Affaticati	Mod. Pos. stepping
3	28/08/2013	M. Giuliani	A. Affaticati	Mod. Alarm / Introd.
4	19/12/2013	M. Giuliani	A. Affaticati	Interlock/speed SOV
5	28/03/2014	M. Giuliani	A. Affaticati	Hand-pump alarm
6	21/06/2017	M. Giuliani	A. Battaglia	FW 3.01.00
7	20/10/2017	M. Giuliani	A. Battaglia	HPU Pump Tables

ECU 1000 Control functions and Local Operator Interface

1 Introduction

The documents DTDE326, DTDE327 and DTDE328 are the **Installation, Operation and Maintenance** manuals of the **ECU1000, Electronic Control Unit** for electro-hydraulic actuators.

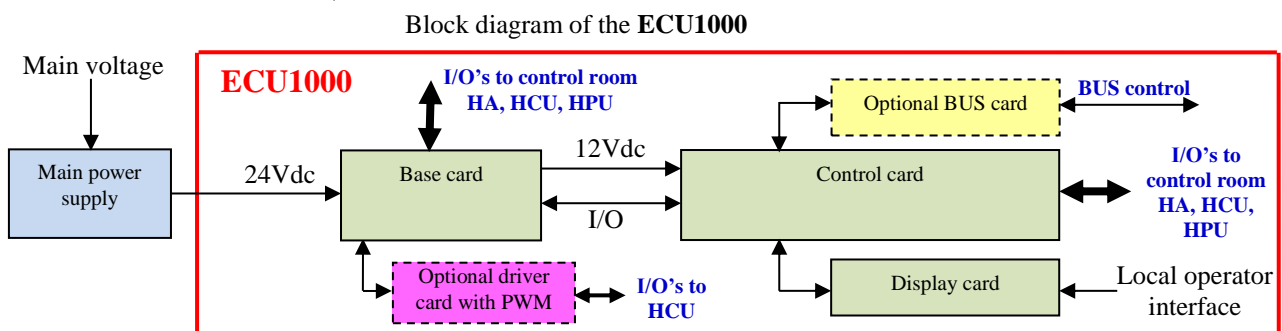
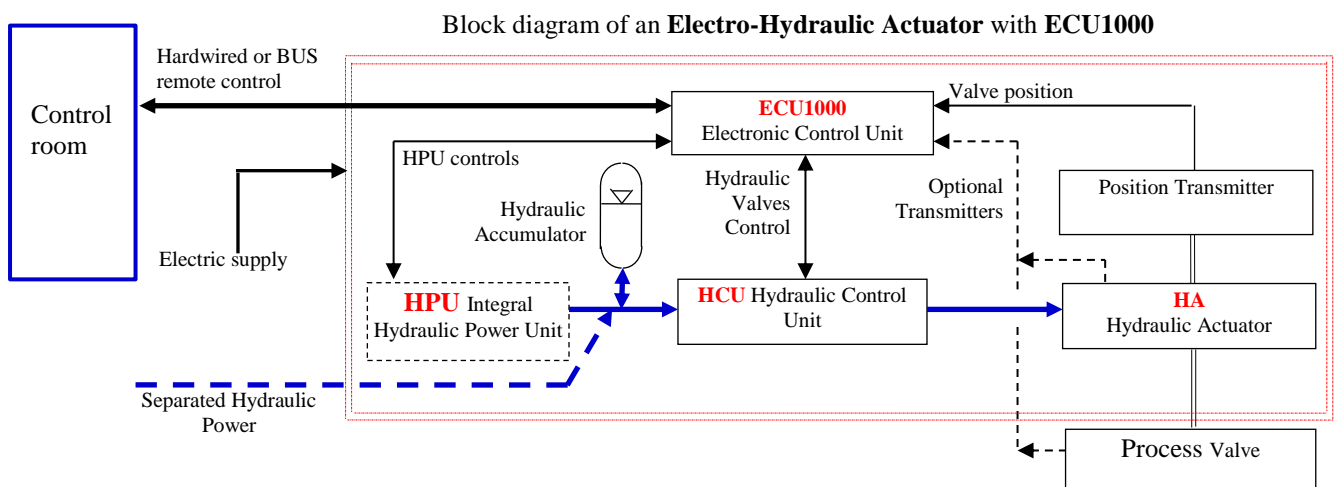
The **DTDE326** “Installation and Maintenance” provides the instructions for the installation and maintenance of cabinet with ECU1000. The **DTDE327** Control functions and Local Operator Interface”, in the paragraphs 1 and 2 provides the general characteristics of ECU1000, in the paragraphs 3,...,17 provides the instructions to use the Positioner and the additional characteristics to control and monitor the actuator, in the paragraphs 19 and 20 provides the instructions of the Local Operator Interface. The **DTDE328** “Input characterization-Recorder-Graph-Logger-PST-HPU-On/Off control-Optional local lamps” provides detailed instructions relevant to further ECU1000 functions (Input characterization-Recorder-Graph-Logger-PST-HPU-On/Off control-Optional local lamps). The manuals DTDE 326, DTE327 and DTDE328 provide the instructions relevant to complete set of ECU1000 functions. Only functions requested by the application and needed to allow the correct actuator control and operation will be activated in the factory setting.

ECU1000 features

The **ECU1000** is a new electronic unit to control an electro-hydraulic actuator for process valves. The main functions are:

- To acquire the feedbacks from sensors of **HA (Hydraulic Actuator)**, **HCU (Hydraulic Control Unit)**, **HPU (Hydraulic Power Unit)**
- To acquire the setpoints from control room
- To process the acquired data and send operational commands to **HA, HCU** and integral **HPU**
- To monitor the **HA, HCU** and **HPU** complete system
- To send to control room signals relevant to status and alarms of complete system
- To log events, alarms and failures

The next figures show the block diagram of the electro-hydraulic actuator with ECU1000.

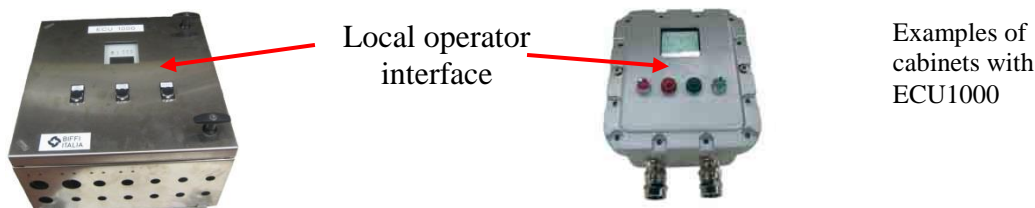


ECU 1000 Control functions and Local Operator Interface

The base version of the ECU1000 consists in 3 electronic boards, Base card, Control card and Display card. Optional cards can be added to drive proportional valves by PWM signals or for bus control. The ECU1000 electronics is supplied at 24VDC power supply. A power supply module should be provided in the cabinet to generate the requested 24VDC.

1.1 Main characteristics of ECU1000

- Control of any BIFFI hydraulic actuator (OLGA-H, OLGAS-H, HLA, HLA-S, single acting spring return and double acting, modulating and on-off service)
- Standard control functions:
 - Positioning of modulating actuator (heavy duty, low drain-heavy duty, stepping)
 - Control of integral HPU with single or dual pump. Automatic switch of electrical pumps
 - Control of on-off actuator
 - Partial Stroke Test
 - Input characterization
 - Failsafe function
 - ESD function
 - Interlock function
 - Stay in position by dedicated SOV
 - Outputs to control Servovalves, Proportional Valves, on-off Solenoid Operated Valves (SOV's), Electrical Motor of hydraulic pumps
 - Inputs to read 4-20mA transmitters and switches
 - Optional module to drive proportional valves by PWM signals
- Hardwired and BUS remote control
- Local control
- Local Operator Interface with graphic OLED display and pushbuttons, visible at very low temperature (-40°C)
- User friendly navigation in the menu. English language menu.
- Diagnostic function
- Full local parameterization.
- Access to parameters protected by four levels of password
- Configuration data saved in 3 separated permanent memories
- 2 Watch-dog timer working in parallel
- Real Time Clock and battery to maintain date and time
- CRC function to validate communication messages and memory content
- Bluetooth wireless communication
- Temperature, humidity and acceleration sensors of electronic cards
- Electronic NAME PLATE of electronic cards
- Failure, Alarm, Event, Connection loggers
- Graph, Recorder and Signatures
- BIFFI-Assistant, SW tool for PC for connection to actuator via Bluetooth or RS232
- Operating temperature from -40 °C to +75 °C
- Electronics suitable to “On-field” operation inside an IP65 or Ex-d cabinet containing:
 - ECU1000 electronic cards
 - Power supply module
 - Line filter, fuses, surge arrester, optional magnetothermal switch
 - DIN RAIL terminals for connection with control room, HA, HPU and HCU
 - Optional Heater



ECU 1000 Control functions and Local Operator Interface

Even if the ECU1000 can work without LOCAL OPERATOR INTERFACE (it means without Display card), it is suggested to use the ECU1000 with its Local Operator Interface. The LOCAL OPERATOR INTERFACE is useful for the following reasons:

- In the commissioning of actuator it allows executing calibration, setting and local control
- In operation it allows viewing maintenance and diagnostic data
- The display works and is visible also at very low temperature (from -40°C)
- No additional tools are required
- On request it can be placed in a separate cabinet
- It provides the wireless Bluetooth option for downloading curves, signatures, logger by PC and BIFFI-Assistant from ECU1000 memory

1.2 Inputs and Outputs of ECU1000

The DTDE326 gives more detailed information relevant to the ECU1000 I/O's.

- **Analogue inputs**

4 x 4-20mA isolated analogue inputs, max voltage drop at 20mA = 9V

1 x 4-20mA isolated analogue input, max input resistance 250 ohm

- **Analogue output**

1 x 4-20mA isolated analogue output, max load resistance 250ohm

- **Servo valve / proportional valve control**

1 x isolated analogue output, configurable by jumpers

- +-10V, +-10mA, +-15mA, +-50mA, +-100mA

1 x digital output, optocoupled

- enable control to servo valve / proportional valve or general output

1 x digital input, optocoupled

- fault status of servo valve / proportional valve or general input

- **Digital inputs**

10 x digital inputs, optocoupled, max voltage 30Vdc

- **Digital output**

1 x digital outputs, optocoupled

- **Output relays**

4 x single side stable, SPDT contact, voltage free

5 x single side stable, SPST NO contact, voltage free

2 x single side stable, SPST NO contact, voltage free (on request latching relays can be provided)

Each input and output is configurable and can be associated either to signals to/from control room or to signals to/from HA, HCU, HPU.

1.3 Status signalling

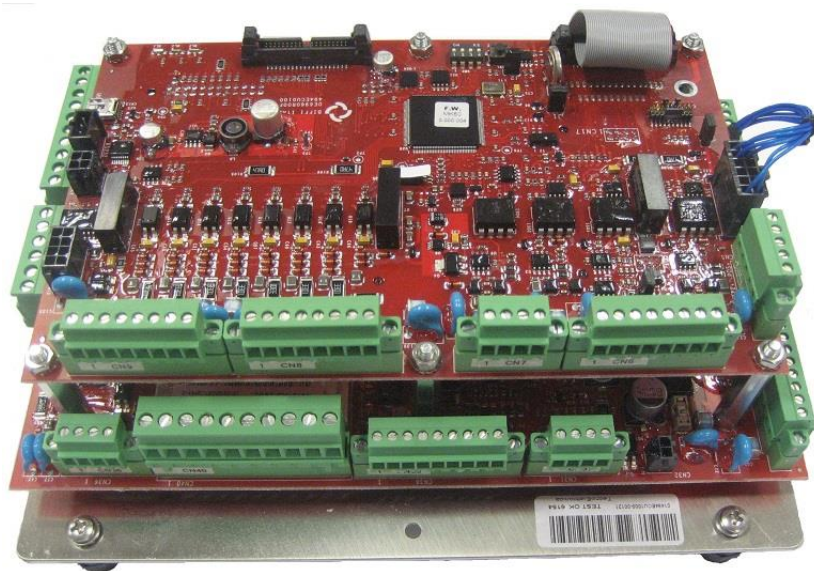
According to NAMUR NE107 the ECU1000 provides the following outputs:

- FAILURE
- ALARM (OUT OF SPEC)
- REMOTE NOT AVAILABLE (FUNCTION CHECK)
- MAINTENANCE REQUIRED

The above statuses are available to the control room by output relays and locally by the ECU1000 Local Operator Interface. By the configuration options the conditions associated to the output relays can be changed.

ECU 1000 Control functions and Local Operator Interface

1.4 ECU1000 Electronic cards



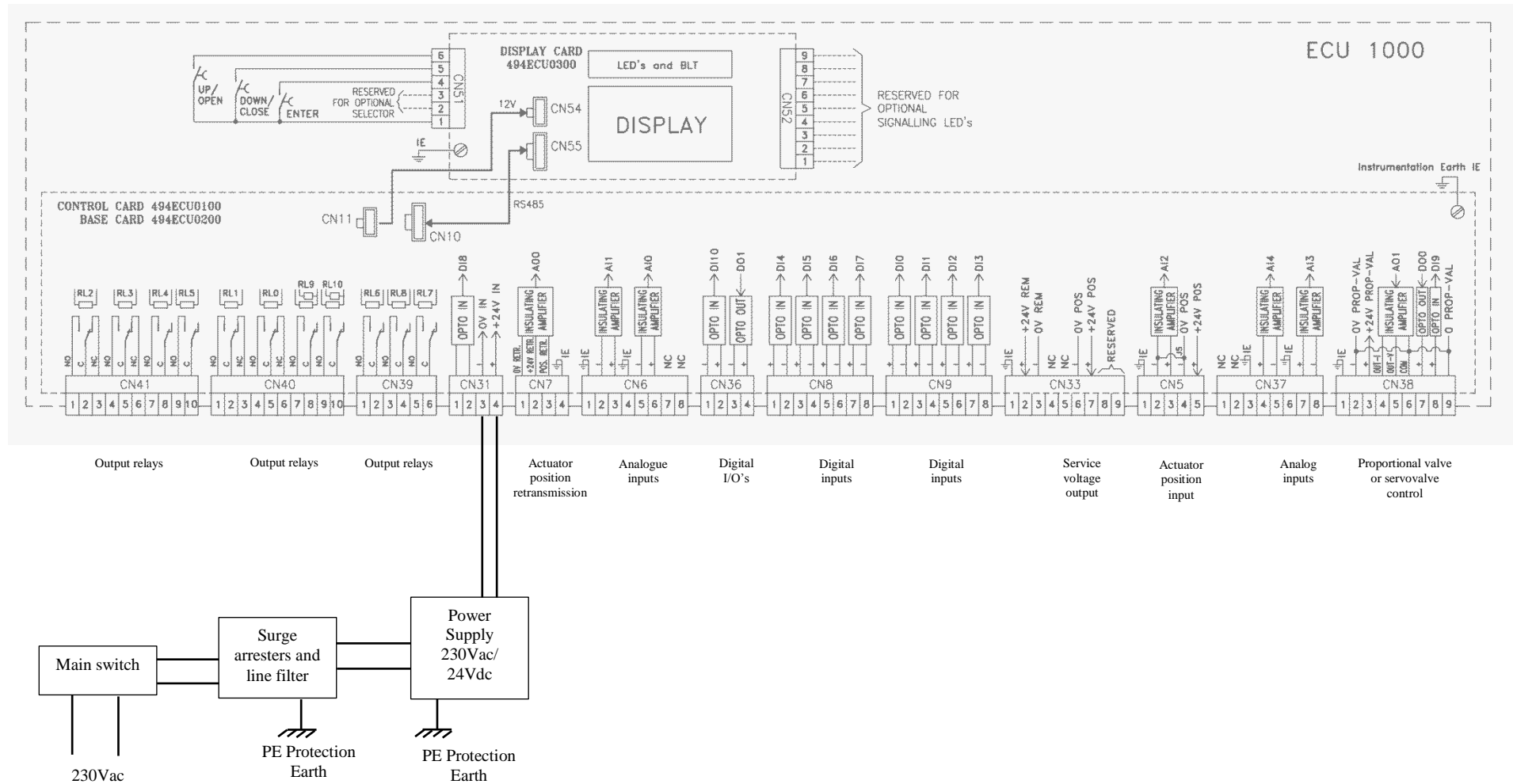
**CONTROL CARD
and
BASE CARD**



DISPLAY CARD

ECU 1000 Control functions and Local Operator Interface

1.5 ECU1000 terminals



2 Positioning function for continuous modulating actuator

In the actuators for continuous modulating service the ECU1000 controls the hydraulic servovalve or proportional valve. The ECU1000 output is an analogue or PWM signal which drives the servovalve or the proportional valve. The Positioning function controls the actuator position by means of a 4-20mA Position Demand signal or a Bus signal coming from Process Control System (DCS, PLC, etc.).

2.1 Inputs and Outputs

This paragraph lists the inputs and outputs used by the Positioning function.

Inputs from control room:

- 4-20mA Position Demand input signal

Inputs and outputs to HCU Hydraulic Control Unit:

- Analogue output: +-10V, +-10mA, +-15mA, +-50mA, +-100mA, configurable by hardware
- Digital input: Fault of proportional valve driver (in case of proportional valve)
- Digital output: Enable of proportional valve driver (in case of proportional valve)
- PWM, 2 channel with additional driver card (to drive PSOV's or proportional valves)

Input and output to HA Hydraulic Actuator:

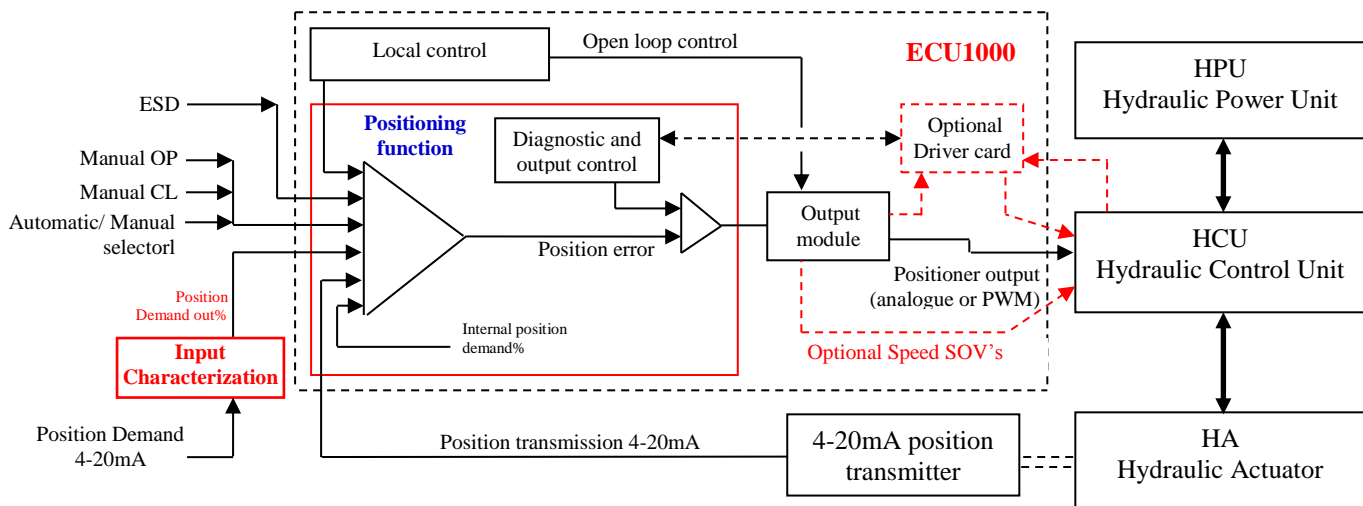
- 4-20mA Actuator Position.
- 24Vdc output to supply the actuator position transmitter

Positioning data:

- Position resolution: 0.1%
- Control algorithm: PI

2.2 Control of servovalves and proportional valves

The figure below shows the block diagram of positioning function of ECU1000.



ECU 1000 Control functions and Local Operator Interface

The ECU1000 sets different operating modes on the base of the input signals and actuator status. Below it is the description of the operating modes.

- **Regular operation**

It is the normal operating mode of positioning function. In **AUTOMATIC** mode the **Position Demand** signal is continuously compared with the **Position transmission** signal. The ECU1000 calculates the difference between Position Demand and Position Transmission (called **Position error**) and drives the actuator in open or close direction until the demanded position is achieved. In **MANUAL** mode the actuator moves in opening or closing according to command Manual OP and Manual CL and when the command stops the actuator maintains the last position. In **LOCAL** the local controls UP/OPEN and DOWN/CLOSE drive the valve in opening and closing.

- **Stay in position**

It is automatically set by the ECU1000. The conditions to have “stay in position” mode are shown in the paragraph “**Actuator malfunction**” tables. In the above mode the ECU1000 maintains the actuator in the last position, memorized before switching from “regular operation” to “stay in position” mode.

- **Tracking**

It is automatically set by the ECU1000. The conditions to have “tracking” mode are listed in the paragraph “**Actuator malfunction**” tables. In the above mode the positioning function sets its output to 0, and no output is generated to drive the actuator. The actuator stays in position or moves depending on the drain of the hydraulic valves (servovalve, proportional valve, solenoid valve).

- **Open loop control**

The Local Operator Interface, by the function “**Open Loop cmd**” in “**ECU cmd, Travel limit setting**” menu, allows moving the actuator without any constraint due to position signal (for instance during calibration of analogue inputs / outputs, travel limit setting, etc.). The positioning function works in tracking mode and the actuator can be moved by the local pushbuttons UP/OPEN and DOWN/CLOSE.

2.3 Parameters of positioning function

The following parameters can be set by the Local Operator Interface:

Dead band: it is the percentage of position error with output equal to 0. If the position error is greater than dead band the positioning function drives the actuator until the position error is smaller than the dead band. The value is small (from 0 to 0.3) in the actuator with standard servovalves and proportional valves. It can be greater in case of SOV or PSOV's with low drain.

Error band OP-K1OP: band of small position error in opening, it is the percentage of error where the positioning function output is proportional to position error with gain K1OP

Gain K1OP: gain used in the band of small position error in opening to calculate the output and drive the HCU

Gain K2OP: gain used in the band of large position error in opening (if position error is larger than error band OP-K1OP). In general K2OP is smaller than K1OP and it is used to increase the actuator speed when position error is great.

Error band CL-K1CL: band of small position error in closing, it is the percentage of position error where the positioning function output is proportional to position error with gain K1CL

Gain K1CL: gain used in the band of small position error in closing to calculate the output and drive the HCU

Gain K2CL: gain used in the band of large position error in closing, (if position error is larger than error band CL-K1CL). In general K2CL is smaller than K1CL and it is used to increase the actuator speed when position error is great.

Integral time Ti: it is the integral time of the Integral function. Normally it is not used (**set to 0**)

Switch to auto time: time to switch from manual to automatic mode. The actuator moves from the last position% to the Position Demand% by a ramp, according to configured “Switch-to-Auto” time.

Demand source: it allows selecting the source of Position Demand signal (4-20mA, bus, internal set value). The option “Internal” is used for test.

Internal position demand: value in % of internal Position Demand

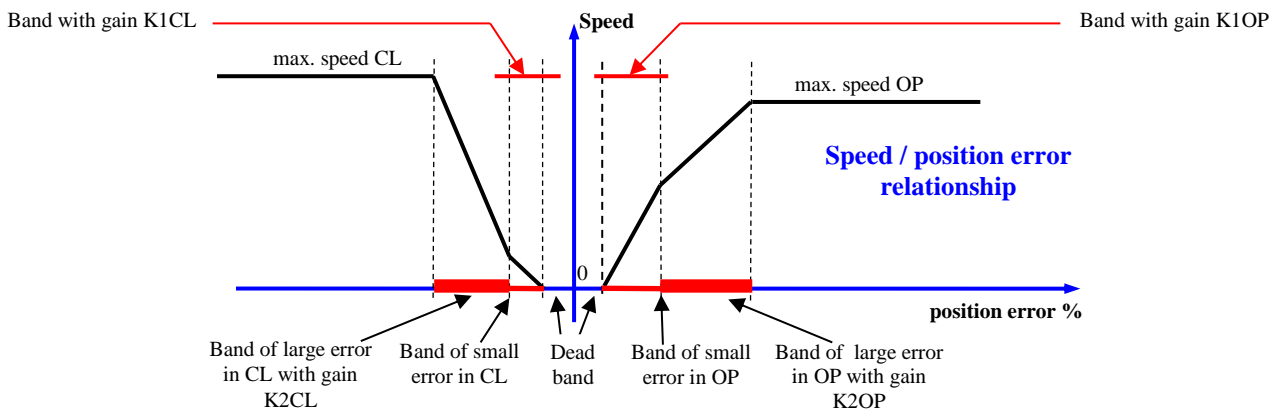
Dither: 200 Hz frequency, configurable from 0 to 10% of output to quickly move the cursor of proportional valve / servovalve

The following parameter can be set only by the customer

Damping factor K1: reduction % of K1OP or K1CL when position demand is >98% or <2%

It allows damping the speed near 0% and 100% and if the Position Demand requires to close or open the valve

The following figure shows the relationship between the above parameters and the actuator speed.

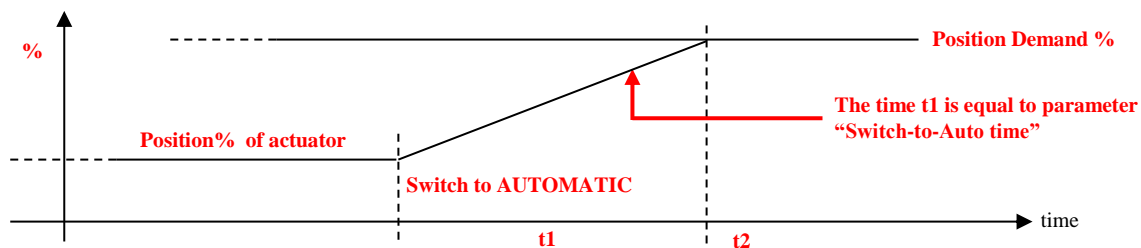


2.4 Output of positioning function

The output of “Positioning function” depends on the HCU. Different outputs are provided to control various types of servovalves and proportional valves. The paragraph 3.1. lists the available outputs.

2.5 Switch to auto mode

If the ECU1000 switches in AUTOMATIC mode, the time needed to reach the Position Demand signal can be configured by the parameter “Switch to auto time”, to avoid bump of valve.



If Position Demand signal is not constant, the time to switch to AUTO is the time requested by the Position signal to cross the Position Demand.

t1: configurable time to switch to AUTOMATIC mode
t2: normal operation in AUTOMATIC

3 Positioning function for stepping modulating actuator

In the hydraulic actuators for stepping modulating service the ECU1000 controls Solenoid Operated Valves (SOV’s). The SOV’s are driven by the output relays of the ECU1000. The max number of starts per hours is 600. The Positioning function controls the actuator position by means of a 4-20mA Position Demand signal or a Bus signal coming from Process Control System (DCS, PLC, etc.). Two SOV’s drive the actuator in opening and closing direction, a third optional SOV (Speed SOV) can be used to reduce the actuator speed when the actuator is close the position to reach (see paragraph 4)

3.1 Inputs and Outputs

This paragraph lists the inputs and outputs used by the Positioning function.

Inputs from control room:

- 4-20mA Position Demand input signal

Outputs to HCU Hydraulic Control Unit:

- relay: open, voltage free, max 30Vdc/230Vac/1A (110Vdc/0.15A)
- relay: close, voltage free, max 30Vdc/230Vac/1A (110Vdc/0.15A)

Input and output to HA Hydraulic Actuator:

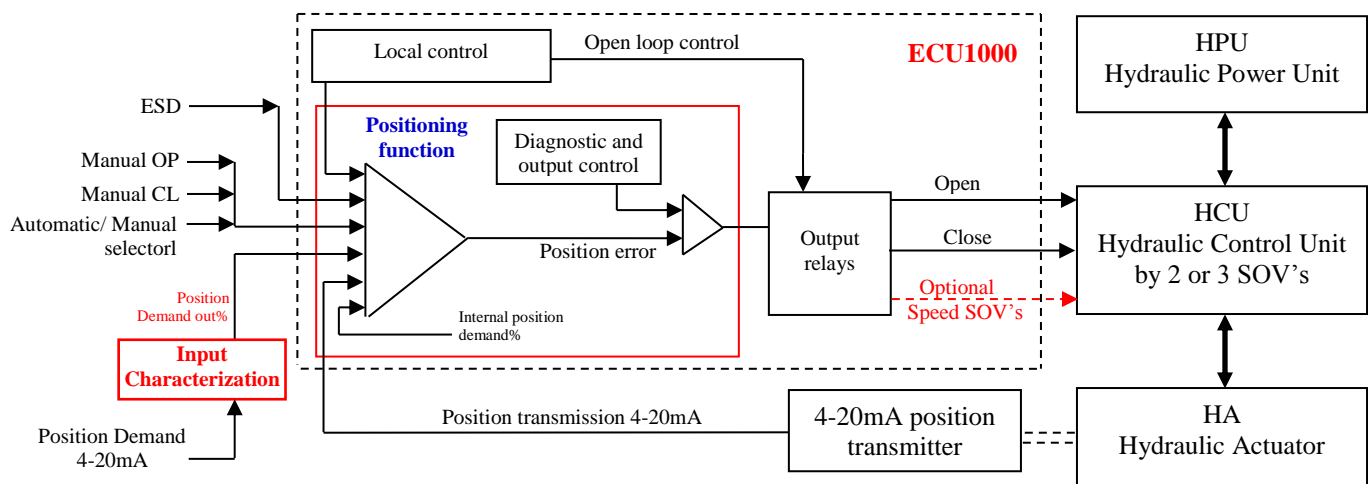
- 4-20mA Actuator Position
- 24Vdc output to supply the actuator position transmitter

Positioning data:

- Position resolution: 0.1%
- Control algorithm: P

3.2 Control of Solenoid Operated Valves

The figure below shows the block diagram of positioning function of ECU 1000.



The ECU1000 sets different operating modes of positioning function on the base of the input signals and actuator status. Below it is the description of the operating modes.

• Regular operation

It is the normal operating mode of positioning function. In **AUTOMATIC** mode the **Position Demand** signal is continuously compared with the **Position transmission** signal. The ECU1000 calculates the difference between Position Demand and Position Transmission (called **Position error**) and drives the actuator in open or close direction until it reaches the demanded position. If the actuator is provided with “**Speed SOV**”, when the position error is smaller than the “**Speed SOV %**”, the “**Speed SOV**” reduces the actuator speed to improve the accuracy in the positioning. In **MANUAL** mode the actuator moves in opening or closing according to command Manual OP and Manual CL and when the command stops the actuator maintains the last position. In **LOCAL** the local controls UP/OPEN and DOWN/CLOSE drive the valve in opening and closing.

• Stay in position

It is automatically set by the ECU1000. The conditions to have “stay in position” mode are shown in the paragraph “**Actuator malfunction**” tables. In the above mode the positioning function maintains the actuator in last position, memorized before switching from “regular operation” to “stay in position” mode.

• Tracking

It is automatically set by the ECU1000. The conditions to have “tracking” mode are shown in the paragraph “**Actuator malfunction**” tables. In the above mode the positioning function sets its output to 0, it updates the position value but no output is generated to control the actuator. The actuator is free to move depending on the drain of the hydraulic valves of HCU.

• Open loop control

The Local Operator Interface, by the function “**Open Loop cmd**” in the “**ECU cmd, Travel limit setting**” menu, allows moving the actuator without any constraint due to position signal (for instance during calibration of analogue inputs / outputs, travel limit setting, etc.). The positioning function works in tracking mode and the actuator can be moved by the local pushbuttons UP/OPEN and DOWN/CLOSE.

3.3 Parameters of positioning function

The following parameters are available in the local menu:

Dead band: it is the percentage of position error with output 0. If the position error is greater than the dead band, the positioning function drives the actuator until the position error is smaller than the dead band.

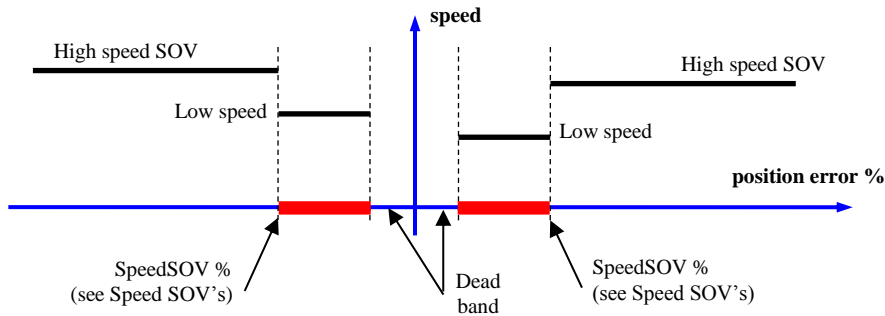
Motion inhibit time: the parameter sets the minimum time between two commands to the open/close SOV's.

Switch to auto time: time to switch from manual to automatic mode. The actuator moves from the last position% to the Position Demand% by a ramp, according to configured "Switch-to-Auto" time.

Demand source: it allows selecting the source of Position Demand signal (4-20mA, bus, internal set value). The option "Internal" is used for test.

Internal position demand: value in % of internal Position Demand

The following figure shows the relationship between the above parameters and the actuator speed. The figure is relevant to an actuator provided with **SPEED SOV** (see paragraph **Speed SOV**)



3.4 Output of positioning function

The paragraph 4.1 lists the available outputs.

3.5 Switch to auto mode

The function works as in the actuator for continuous modulating service. The paragraph 2.5 describes the characteristics of the function

4 Speed SOV's

This function allows increasing/decreasing the speed of the actuator when the following conditions occur:

- position error % is greater than the configurable reference value "**Speed SOV %**"
- the position is > 10%
- the position is < 90%

Two options are available:

- 1 output relay of ECU1000 to drive 1 only SOV
- 2 output relays of ECU1000 to drive 2 SOV's, one for each direction OP and CL

As further option, 1 SOV can be controlled by a solid state switch on the optional PWM driver card (see DTDE328 instruction manual). The Speed SOV's are used when the actuator is requested to be precise in the positioning but also to have a high travelling speed. The function can be activated only by the manufacturer and depends on the hydraulics of actuator and end user request. It can be activated both in "Positioning function for continuous modulating actuators" and "Positioning function for stepping modulating actuators". The Speed SOV's are always off in Local control, Manual control, PST, Failsafe, Configuration and Stay in position by SOV.

Outputs to SOV features:

- relay: voltage free contact, max 30Vdc/230Vac/1A (110Vdc/0.15A)
- solid state driver: 24Vdc /1A, present on the PWM module

Parameter of "Speed SOV":

- **Speed SOV %:** position error % to energize/de-energize the Speed SOV's (hysteresis 1%, min1%, max 50%)

The parameter is available in the **POSITIONER** menu with username "OPERATOR".

5 ESD function

The ESD command overrides any other command and allows executing an emergency action. The ESD action is active until the command is present. The end user can set the ESD action to be active when the signal is present or absent. ESD function is off in LOCAL control mode. More ESD inputs can be configured, according to the end user request. Both inputs can be set to work as wired OR or AND. The local display shows the message “ESD” if the ESD” is on”. The following parameters can be used to modify the response to ESD command:

ESD action:

- Off : ESD command not used
- Tracking: the ESD command is executed by a dedicated SOV. The positioning function does not generate any output to control the actuator
- Stay in position: the positioner maintains the last position
- Go to position%: in presence of an ESD command the positioning function drives the actuator to the configured position

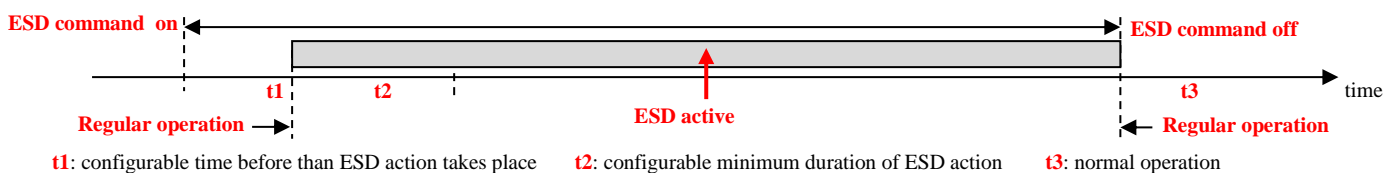
ESD position: position % if the option selected is “go to position %”

ESD logical operator: the available options are OR and AND. The parameter is used in case of multiple ESD input signals.

ESD delay: duration of signal before initiating ESD action (see “t1” in the drawing below)

Min ESD duration: min duration of ESD action even if the ESD command is a pulse

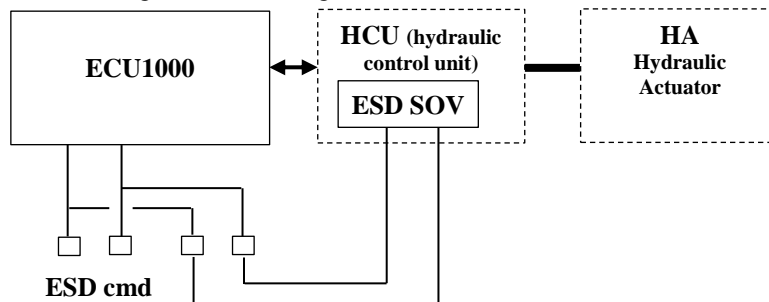
ESD signal type: it selects the type of ESD command signal (present, absent)



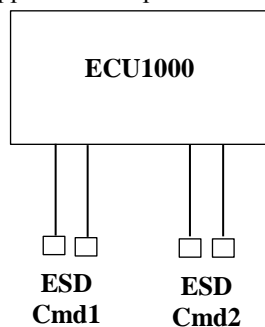
The time “t1” is the minimum duration of the ESD signal to initiate the ESD action. It is obtained by the sum of “ESD delay” + “min ESD cmd (>0.7 sec).

The maximum speed in ESD is configured by the customer.

Note: the ESD command can be executed by the modulating hydraulic control valve (proportional valve / servovalve, etc.), but in general, the HCU has a dedicated SOV to execute ESD action. The ESD command must be connected to the ECU1000 according to the below figure and the ESD action should be “Tracking”.



Example of application of parameter “ESD logical operator”



If parameter “ESD logical operator” is configured “OR”, the ESD action takes place according to relationship “ESD cmd1 OR ESD cmd2”

If parameter “ESD logical operator” is configured “AND”, the ESD action takes place according to relationship “ESD cmd1 AND ESD cmd2”

6 Failsafe

The FAILSAFE function allows the actuator performing a configured action if one of FAILSAFE conditions occurs. The configurable conditions to initiate the FAILSAFE are

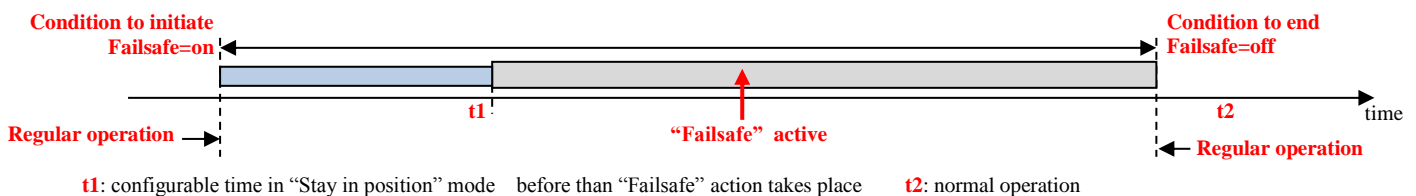
- **Position Demand:** failure of 4-20mA Position Demand if the actuator is controlled by an analogue signal
- **BUS control:** failure of bus signal if the actuator is controlled by bus
- **Fail to position:** alarm due to position error >4% (see Alarm table par 15.2)
- **HPU failure:** failure due to HPU. The failure exits only if
 - The actuator is provided with integral HPU
 - HPU is configured to generate a failure (see Failure table par 15.1 and manual DTDE 328)

The paragraph “**Actuator malfunction tables**” reports the **Failure** and **Alarm** conditions. To control the actuator by local pushbuttons UP/OPEN, DOWN/CLOSE is available. The configurable actuator actions are: off, tracking, stayput, go to position. The following options can be set:

Action delay: delay in second before executing the configured action. The actuator stays in position in the delay time.

Action of actuator: action of actuator

- Off : function not active
- Tracking: The positioner does not generate any output to control the actuator (positioner out=0)
- Stay in position : the positioner maintains the last position
- Go to position%: the positioner drives the actuator to the configured position
- Position %: position % if the option selected is “go to position %”



The “Failsafe” function is activated by the manufacturer on the base of actuator type and user request. The manufacturer also sets the maximum speed in “Failsafe”. When “Failsafe” is on, the local display shows the message “Failsafe”

7 Interlock

The Interlock function is used to inhibit the actuator controls in one or both directions according to the setting done by the manufacturer. The Interlock control can be generated by

1. **digital inputs:** an electrical signal connected to the ECU1000 digital inputs and coming from control room or from on-off sensors (pressure, temperature, level, etc.) can be configured to inhibit open or close or both open/close commands from remote or local. Interlock action can be configured to be active when digital signal is on or off.
2. **4-20mA analog input:** an electrical 4-20mA signal connected to the ECU1000 analogue inputs and coming from control room or from 4-20mA transmitter (pressure, temperature, level, etc.) can be configured to inhibit open or close or both open/close commands from remote or local if the value of 4-20mA input is greater or less than the reference “AI-Ref.” Interlock action can be configured to be active when the analogue signal is “**greater than**” or “**less than**” the configurable reference “AI-Ref.”
3. **digital commands from BUS:** the Interlock commands from bus can inhibit open or close or both open/close commands from remote or local. See the relevant instruction manual of bus.
4. **4-20mA oil pressure transmitter of HPU:** if the actuator is provided with integral HPU and 4-20mA to control the HPU pressure, the Interlock function can be used to inhibit **both open and close** commands from remote or local when the HPU pressure is “**less than**” the configurable reference “Int-HPU-Pres”

The alarm “Fail to position” is not active in the direction of Interlock. Configuration of Interlock function can be done only with username “Specialist” or “Guest2”. Change of reference values can be done also with username “Service”. When “Interlock” is on, the local display shows the message “Interl”

8 Stay in position by SOV

The function can be activated by the manufacturer and requires an **optional SOV** connected to an output relay of the ECU1000. The ECU1000 energizes / de-energizes the dedicated **Solenoid Operated Valve SOV (SOV1)** when a **configurable set of events occurs**. The action of the SOV depends on the hydraulic connections in the HCU (Hydraulic Control Unit). In general the SOV keeps the actuator in **POSITION**, but it could be also used to force the actuator in open or close position according to the hydraulic connections. The configurable events to activate the “Stay in position by SOV” are:

- **failure of Actuator Position signal**
- **failure of Position Demand signal**
- **Temperature out of range**
- **Power Supply out of range**
- **SW error0**
- **Fail to position**
- **Failure of Bus control signal**
- **HPU failure.** The action is performed only if
 - The actuator is provided with integral HPU
 - HPU is configured to generate a failure (see Failure table par 15.1 and manual DTDE328)

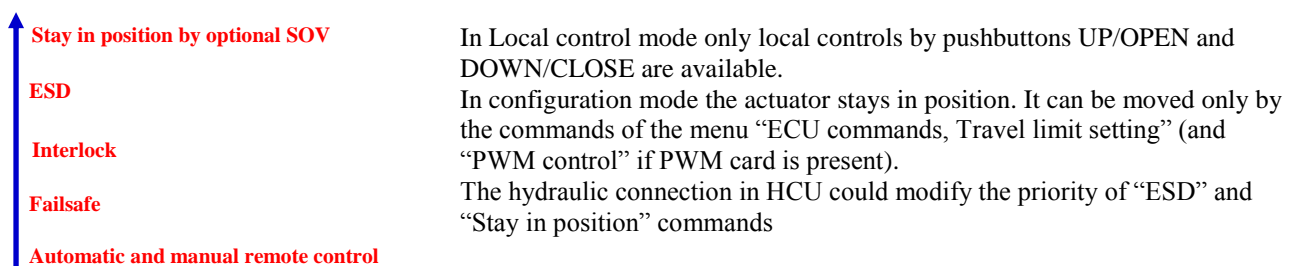
The output to SOV is cleared only if the condition that causes the SOV to be active disappears. When the function is active the positioner switches in “**Tracking**” mode.

The conditions of the “**HPU failure**” are described in the paragraph 15 “**Actuator malfunction tables**” and DTDE328. The following additional parameters can be set only by the manufacturer: Optional SOV1 conditions, Optional SOV1 relay logic operator (default OR), optional SOV1 start delay (default 0 sec), Optional SOV1 stop delay (default 6 sec), Optional SOV1 relay coil (default energized).

When “Stay in position by SOV” is on, the ECU1000 signals “**FAILURE**” (due to “**STAYPUT by SOV**”) and the local display shows the message “**SOV1**”

9 Priority of commands

The following diagram shows the priority of commands when actuator works in remote control mode. The “Stay in position by optional SOV” has the highest priority and overrides any existing commands (if enabled). Automatic and manual remote controls have the lowest priority.



10 Output 4-20mA

The output 4-20mA can be configured by the user according to the following options:

- Out. 4-20mA: position retransmission or position demand
- Polarity 4-20mA out: it allows reversing the polarity of output 4-20mA signal.

11 Date

The function is used to set the following parameters

Date and Time: it sets the present date and time.

Start-up date: it is a maintenance parameter. The user can set the working start date of the actuator in the plant

Maintenance request date: it is a maintenance parameter. The user can set the date of the next planned maintenance. It generates the “maintenance required” information (see paragraph “Actuator malfunction tables, Maintenance required table”).

12 Miscellaneous

The function includes various types of parameters.

Time to reach posit: it is used to generate the alarm “**Fail to position**” (described in the paragraph “**Actuator malfunction tables**”, “**Alarm table**”) if the position error complies with the following conditions

- In automatic mode : the maximum time with position error > 4% is greater than “**Time to position**” in seconds
- In manual mode : actuator is not moving

User password: it allows changing the password **level 1** (corresponding to username **USER**)

Operator password: it allows changing the password **level 2** (corresponding to username **OPERATOR**)

Bluetooth name: it selects the Bluetooth name (cabinet serial number, actuator serial number, valve tag)

DL1 close colour: it selects the colour of DL1 LED CLOSE of Local Operator Interface (green or red)

DL2 alarm colour: it selects the colour of DL2 LED ALARM of Local Operator Interface (yellow or red)

DL3 open colour: it selects the colour of DL3 LED OPEN of Local Operator Interface (green or red)

13 Output relay

The standard configuration provides 4 output relays to signal “FAILURE, ALARM, REMOTE NOT AVAILABLE, FAIL to POSITION” to control room. The configuration of each relay can be changed by the end user. The manufacturer can change the number of available relays on request of end user.

The list of options available for each relay is shown in the below “**Status relay table**”.

The following parameters are available:

RLx condition: it allows selecting one or more conditions of “**Status relay table**” to trip the relay contacts

RLx pos<%: it allows to set the position% if the condition is “Position < xx%”

RLx pos>%: it allows to set the position% if the condition is “Position > xx%”

RLx logic operator: in case of selection of more conditions it allows to put them in OR or AND

RLx coil: it allow selecting to energize the coil when conditions occur and viceversa

Example: to set the relay RLx to switch when the actuator position is <10% or >90% by the ECU1000 local operator interface.

In the menu “Actuator setup, Out relay”, select the relay RLx. Select “RLx condition”, enable the 2 conditions “Position<xx” and “Position>xx”. The enabled status is shown by the symbol “>”. Select “RLx POS<% and enter the value “10%”. Select “RLx POS>%” and enter “90%”. Select “RLx Logical Operator” and set “OR”. Select “RLx coil” and set “Energized or de-energized”.

13.1 Status relay table

Name	Description
Actuator status summary	
Failure	It collects the failures of table 15.1 (See "Failure" table)
Alarm (Out of spec.)	It collects the alarms of tables 15.2 and 15.3 (See "Alarm" tables)
REMOTE not available (Function check)	It collects the conditions of table 15.4 (See "Remote not available" table)
Maintenance required	It collects the conditions of table 15.5(See "Maintenance required" table)
Nu	Not available
Actuator status	
Open limit	Actuator fully open
Close limit	Actuator fully closed
Position < xx%	Actuator position < xx%
Position > xx%	Actuator position > xx%
Intermed. position	Actuator in intermediate position
Opening	Actuator opening
Closing	Actuator closing
Configuration	Configuration mode
Local	Actuator in local control
Remote	Actuator in remote control
ESD	ESD control active
Interlock	Interlock active
Nu	Not available
PST	PST function active (available only if PST function is enabled)
PST failed	PST result "failed/aborted" (available only if PST function is enabled)
Nu	Not available
Actuator failure and alarm	
Position demand	Position Demand signal out of range
Actuator position	Actuator position signal out of range
Failure to position	Time to have error < 4% greater than parameter "Time to position"
Proportional valve	Available only if proportional valve or its drive have the failure feedback signal
Power supply	Power supply out of range
PWM Utilization %	Only if PWM module is active. It signals strong use of the PWM controlled hyd. valve
Electronic failure	It collects the "electronic failures" of table 15.1 (See "Failure" table)
Electronic alarm	It collects the "electronic alarms" of table 15.2 (See "Alarm" tables)
Nu	Not available
Nu	Not available
HPU signals (Available only if HPU control is active)	
HPU status summary	
Pump1 alarm	It collects all alarms of HPU and pump1 (See table 15.3)
Pump 2 alarm	It collects all alarms of HPU and pump2 (See table 15.3)
HPU status	
Pump 1 motor on	Motor of pump1 on
Pump 2 motor on	Motor of pump2 on
Discharge SOV on (DSOV)	Discharge SOV on
HPU malfunction / Out of spec	
HPU pres. transm.	Pressure transmitter of HPU out of range
High oil pressure	Oil pressure > reference
Low oil pressure	Oil pressure < reference
Oil temperature (high)	High oil temperature
Oil level (low level)	Low oil level
HPU gener. sens.	General on-off sensor of HPU
Hand-pump	Hand-pump operation
HPU sign sw	HPU signalling on-off sensor (for instance "HPU oil filter")
Pump1 power sup.	Failure of electrical power supply of pump1 motor
Pump1 mot. TH (motor temperature)	High temperature of pump1 motor
Pump1 filter	Clogged filter of pump1
Gener. sens. pump1	General sensor of pump1
Max time pump1	Time to reach the working pressure > reference time "Max time to pressure"
Pump2 mot. Sup. (electrical power supply)	Failure of electrical power supply of pump2 motor
Pump2 mot. TH (motor temperature)	High temperature of pump2 motor
Pump2 filter	Clogged filter of pump2
Gener. sens. pump2	General sensor of pump2
Max time pump2	Time to reach the working pressure > reference time "Max time to pressure"

14 Travel limit setting

The procedure consists in the following steps

- Setting of actuator mechanical stops
- Calibration of zero and span of 4-20mA position transmitter
- Setting of electronic travel limits

Setting of travel limits is done by the **Local Operator Interface**. The instructions to use the Local Operator Interface are in the **paragraphs 19 and 20**.

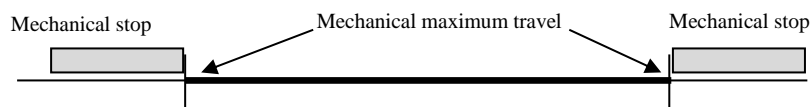
Setting of mechanical stops and 4-20mA position transmitter must be done before initiating the setting of electronic travel limit.

The below instructions allow setting the mechanical stops and the 4-20mA position transmitter by means of the command **“OPEN LOOP CMD”**, function block **“ECU cmd”**, function TAB **“Travel limit setting”** in the **Local Operator Interface**. The command is available with **password level 2**. The command **“Speed”**, in **“ECUcmd, Travel limit setting”** allows selecting the output/speed of actuator in the limit setting operations. The default value is 10%. The above commands allow moving the actuator by the UP/OPEN and DOWN/CLOSE pushbuttons at low speed and ignoring the value of position transmitter and the existing travel limits.

14.1 Mechanical stops

If mechanical stops are not in the correct position it needs to adjust them. Refer to mechanical setting instruction book of actuator.

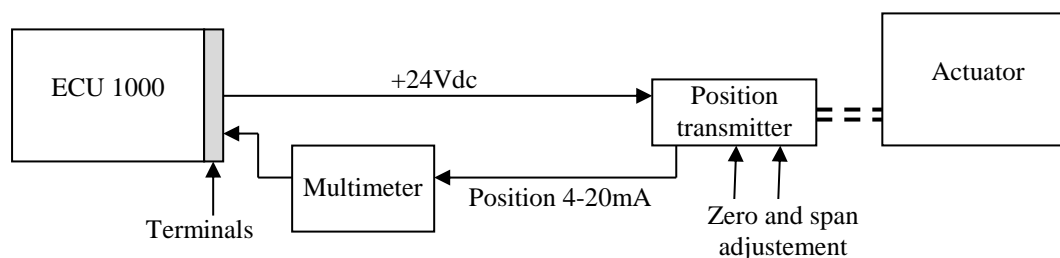
From **HOME VIEW** of local display, by ENTER select username and password and then **“ECU cmd”**, **“Travel limit setting”**, **“OPEN LOOP CMD”**. Press ENTER. By UP/OPEN and DOWN/CLOSE move the actuator and adjust the open and close mechanical stops to obtain the desired maximum travel of actuator and process valve.



If mechanical stops are not present or not used only calibration of 4-20mA position transmitter is required.

14.2 4-20mA position transmitter

Connect the multimeter in series to the 4-20mA position transmitter signal according to the following diagram.



From HOME VIEW of local display, by ENTER select username and password and then **“ECU cmd”**, **“Travel limit setting”**, **“OPEN LOOP CMD”**. Move the actuator in fully closed position and set the zero of transmitter to 3.9mA. Move the actuator in fully open position and set the span of transmitter to 20,1mA. The 4-20mA range must be smaller than the mechanical maximum travel.

14.3 Electronic setting of travel limits

After having set the mechanical stop and the 4-20mA position transmitter it is necessary to set the electronic limits by means of the **Local Operator Interface**.

Setting of electronic limits depends on the parameters in “**Restricted, Travel limit, Open limit mode and Close limit mode**”. Two options are available:

- Travel limit on reaching the configured position in bit (mode: **position**)
- Travel limit on reaching the mechanical stops (modes: **continuous, position change, cycle**)

Each option is configurable separately for open and close with password level 2.

By the commands “**Open/Close limit manual set**”, “**Open/closed limit autocalibration**”, “**Change open/close limit**”, in the “**ECU cmd, Device cmd, Travel limit setting**” menu of the **Local Operator Interface**, the ECU1000 memorizes the values in bit corresponding to positions 0% and 100%.

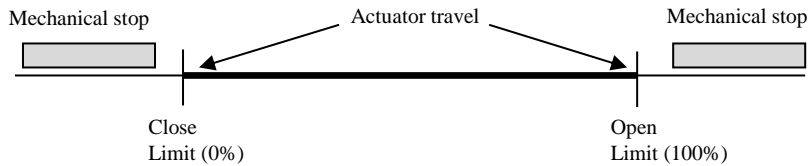
The next paragraphs provide the instructions to set the electronic travel limits in case of “Travel limit on reaching the configured position” or “Travel limit on reaching the mechanical stop”.

Before executing the procedure relevant to “setting of travel limits”, it is mandatory to set the mechanical stop of actuator and the calibration of 4-20mA position transmitter

14.3.1 Travel limit on reaching the configured position

The above option is available if the parameter “**Restricted, Travel limit, open limit mode or closed limit mode**” is set to “**position**”

The actuator stops when it reaches the configured open or close limit position. Positioning function keeps the actuator in the travel limit position. The Open / Close LED in the Local Operator Interface is ON. The hysteresis on signalling by LED's and relays is 0.5%. Mechanical stops should be positioned externally to the desired actuator travel as shown in the below figure.



The procedure to set travel limits by **position** is the following:

Open limit:

- Enter in the menu “View param ”.
- In “Restricted, Travel limit” check that “open limit mode” is “**position**”.
- Exit and return to HOME VIEW.
- Enter in the menu “ECU cmd, Travel limit setting”.
- Set a low operation speed, by the parameter SPEED (10-70%)
- Select the option “Op limit manual set”. By UP/OPEN and DOWN/CLOSE move the actuator to the desired open position. By ENTER save the open position limit.
- Exit and return to HOME VIEW.

Close limit:

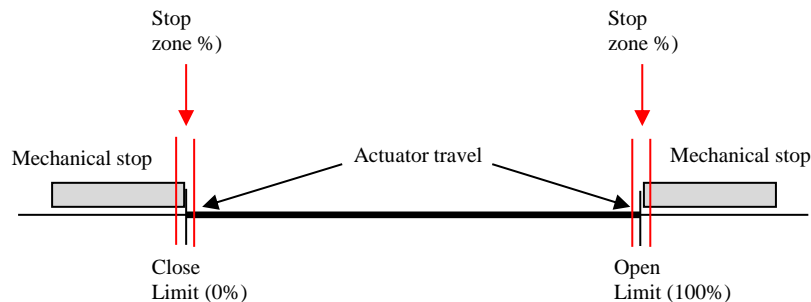
- Enter in the menu “View param”.
- In “Restricted, Travel limit” check that “close limit mode” is “**position**”.
- Exit and return to HOME VIEW.
- Enter in the menu “ECU cmd, Travel limit setting”.
- Set a low operation speed, by the parameter SPEED (10-70%)
- Select the option “Cl limit manual set”. By UP/OPEN and DOWN/CLOSE move the actuator to the desired close position. By ENTER save the close position limit.
- Exit and return to HOME VIEW

The option “**Open and Close limit autocalibration**” **CANNOT BE USED**.

14.3.2 Travel limit on reaching the mechanical stop

The above option is available only if the parameter “**Restricted, Travel limit, open limit mode or closed limit mode**” is set either “**continuous or position change or cycle**”

The actuator stops when it reaches the mechanical stops. Every time the actuator reaches the mechanical limit, the corresponding actuator position% of actuator could be slightly different, due to different operating conditions (pressure, temperature, etc).

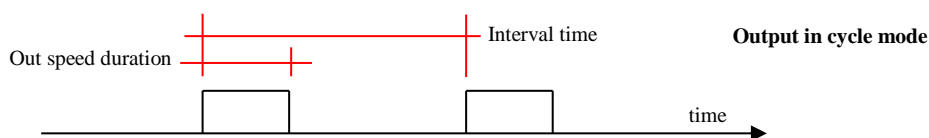


The options “**continuous**”, “**position change**” and “**cycle**” allow changing the actuator control while it is on the travel limit. The most used option is “**continuous**”.

Continuous: when the actuator is close the end of travel (in general few %), the output of positioning function is set to a constant value. If the position is stable, the ECU1000 assumes the reached position as “end of travel” but the output is maintained on and the actuator constantly pushes against the mechanical stop. Local LED’s and relays signal “open/closed end of travel”. Command in opposite direction is generated only if Position Demand is > 2% (<98%) or by manual command.

Position change: when the actuator is close the end of travel (in general few %), the output of positioning function is set to a constant value. If the position is stable, the ECU1000 assumes the reached position as “end of travel” and the output of positioning function goes to zero. Local LED’s and relays signal “open/closed end of travel”. If the actuator moves few% from the end of travel position”, it is driven to return to previous position with constant speed and duration of command. Command in opposite direction is generated only if Position Demand is > 2% (<98%) or by manual command.

Cycle: when the actuator is close the end of travel (in general few %), the output of positioning function is set to a constant value. If the position is stable, the ECU1000 assumes the reached position as “end of travel” and the output of positioning function goes to zero. Local LED’s and relays signal “open/closed end of travel”. Cyclically an output command is generated to maintain the actuator in the end of travel position. Maximum speed, time between pulses and duration of command are constant. Command in opposite direction is generated only if Position Demand is > 2% (98%) or by manual command.



Before executing the procedure “**Setting of travel limits on reaching the mechanical stop**”, it is mandatory to set the mechanical stop of actuator.

If the actuator is not provided of mechanical stops the above option **CANNOT BE USED**.

ECU 1000 Control functions and Local Operator Interface

The procedure to set travel limits **on mechanical stops** is the following:

Open limit:

- Enter in the menu “View param”.
- In “Restricted, Travel limit” check that “open limit mode” is “**continuous** or **position change** or **cycle**” (the choice depends on the type of process valve and actuator).
- Exit and return to HOME VIEW.
- Enter in the menu “ECU cmd, Travel limit setting”.

Automatic setting of open limit:

- Check that mechanical open stop is correctly set
- Set a low operation speed, by the parameter SPEED (10-70%)
- Select the option “**Open limit autocalibration**”.
- At the end of autocalibration procedure exit and return to HOME VIEW.

Close limit:

- Enter in the menu “View param”.
- In “Restricted, Travel limit” check that “close limit mode” is “**continuous** or **position change** or **cycle**” (this choice depends on the type of process valve and actuator).
- Exit and return to HOME VIEW.
- Enter in the menu “ECU cmd, Travel limit setting”.

Automatic setting of close limit:

- Check that mechanical close stop is correctly set
- Set a low operation speed, by the parameter SPEED (10-70%)
- Select the option “**Close limit autocalibration**”.
- At the end of autocalibration procedure, exit and return to HOME VIEW

14.4 Change open /close limit function

This function allows modifying the existing travel limit without repeating the complete procedure. The option can be used only in case of “**travel limit on reaching the configured position**” (described in the paragraph 14.3.1)

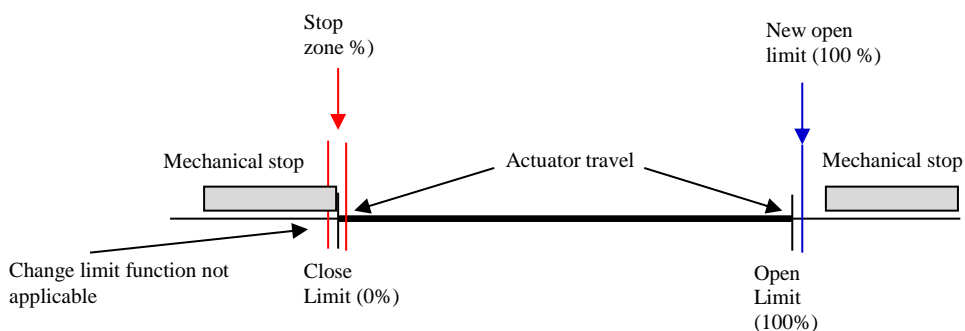
The procedure is the following:

Open limit:

- Enter in the menu “ECU cmd, Travel limit setting”.
- Select the option “Change open limit”. By UP and DOWN enter the desired value. By ENTER save the new value of position.
- Exit and return to HOME VIEW

Close limit:

- Enter in the menu “ECU cmd, Travel limit setting”.
- Select the option “Change open limit”. By UP and DOWN enter the desired value. By ENTER save the new value of position.
- Exit and return to HOME VIEW



14.5 Bias adjustment of driver and valve purge



BIAS adjustment

The adjustment of BIAS of ATOS driver card is performed in factory in the test operation. If the ATOS driver card must be replaced, it is necessary to adjust the BIAS of the new card. The procedure is the following:

- Enter in the menu “ECU cmd, Travel limit setting”.
- Select the option SPEED. The default value is 10%. Press ENTER if it is OK or change the value by UP and DOWN
- Select the option “Open loop cmd”. By UP and DOWN move the valve to about 50%.
- By a screwdriver rotate the screw of BIAS until the actuator position in bit on the ECU1000 display is stable
- Exit and return to HOME VIEW

Purge

The purge operation is used to exhaust the air that could be present into the hydraulic circuit, immediately after the hydraulic supply connection, or after proportional valve re-installation. (See the documentation relevant to ATOS Proportional Valve).

- Enter in the menu “ECU cmd, Travel limit setting”. Select the option SPEED. The default value is 10%. Press ENTER if it is OK or change the value by UP and DOWN.
- Select the option “Open loop cmd”. By UP and DOWN move the valve to about 50%.
- Unloose *carefully* the purge screw (see ATOS documentation) and then press alternatively the OPEN / CLOSE push-buttons until the oil flows out without air.
- Re-tight the purge screws and cleans the proportional valve from the oil.
- Exit and return to HOME VIEW

15 Actuator malfunction tables

15.1 Failure table (NAMUR NE107: FAILURE)

Name	Description	Actuator operation	Failure status	Failure reset
General failure				
Position demand (1)	Position demand signal out of range	Configured "FAILSAFE" action (8) (10)	x	Position Demand in the correct range
Bus control (9)	Bus control is off	Configured "FAILSAFE" action (8) (10)	x	Bus signal is correct
Actuator position	Actuator position signal out of range	Tracking (no out) (3)	x	Actuator position in the correct range
Proportional valve (2)	Proportional valve driver malfunction	Tracking (no out) (3)	x	Feedback from proport. valve driver correct
Power supply	Power supply <20Vdc or >30Vdc	Tracking (no out) (3)	x	Power supply in the correct range
Failsafe (6)	Failsafe mode active due to configured conditions	Configured "FAILSAFE" action	x	Failsafe condition removed
Stayput by SOV (5)	Stay in position by optional SOV active due to configured conditions	Stay in position	x	Stay in position condition removed
Electronic failure				
Temperature	Temperature of electronics <-45°C >90°C	Tracking (no out) (3)	x	Electronics repaired
SW error 0	The 3 memories containing the working parameters are damaged	Tracking (no out) (3)	x	Electronics repaired
Hardware 0	Hardware failure	Tracking (no out) (3)	x	Electronics repaired
HPU failure				
HPU failure (4)	Fault of integral HPU (if present)	No change of actuator operation (7) (10)	x	HPU repaired

(1) **Position Demand:** local control, configuration and manual operations are available. The failure is not generated in the on-off actuator

(2) **Proportional valve:** available only if the ECU1000

- controls the "driver card" of the proportional valve and this driver card has the **FAULT** output signal connected to an ECU1000 digital input (Atos proportional valve type)
- controls a "proportional valve with integrated electronic driver" and the valve has a monitoring 4-20mA output signal connected to an ECU1000 analogue input (Moog proportional valve type)
- controls the optional "Biffi PWM driver card" and the power supply is out of range (18-30Vdc) (see DTDE328) (in case of standard proportional valves without transducer, 1 or 2 coil)
- controls the optional "Biffi PWM driver card", the power supply is out of range (18-30Vdc) (see DTDE328) or the position of PSOVS's cursor is 0 (in case of Biffi PSOVS's proportional valves)
- the failure is not generated in the actuators with servovalves controlled by current (+-10,...,+100mA) without feedback signal and in the on-off actuators

(3) **Tracking:** electrical signal to drive the proportional valve/servo valve/SOV is set to 0 (output of positioning function = 0).

(4) **HPU failure:** in the default configuration the HPU malfunctions generate **only alarms** (see ADDITIONAL ALARM TABLE) and only if the actuator is with integral HPU. **On request** the ECU1000 can be set to generate an **HPU failure**

(5) **Stayput by SOV:** it exists only if the "Stay in position by optional SOV" function is on

(6) **Failsafe:** it exists only if Failsafe function was configured "on"

(7) In the default configuration the "HPU failure" does not change the actuator operating mode. On request ECU1000 can be set to initiate the **Failsafe** or the "Stay in position by optional SOV" functions

(8) In the default configuration the "Position Demand" and "Bus control" failures initiate the configured **Failsafe** action. **On request** the ECU1000 can be set to "No change actuator operation" or "Stay in position by optional SOV"

(9) **Bus control:** the Failure exists only if the actuator is controlled by Bus

(10) In general if the function "Stay in position by optional SOV" is enabled the "Failsafe" function is disabled and viceversa

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15.2 Alarm table (NAMUR NE107: OUT of SPEC)

Name	Description	Actuator operation	Alarm	Alarm reset
General alarm				
Hyd. Valve Leak (4)	Valve leakage (only ON-OFF actuator)	Regular operation	x	Check PSOV/autocal./check SOV (4)
Fail to position (2)	Posit error >4% after configurable time or no position change in manual	Regular operation (3)	x	Position error < 4% (2)
Stroke limit (1)	Travel limit not correct	Regular operation	x	See note below
PWM Utilization % (5)	PWM utilization rate greater than reference (PWM % <Reference)	Regular operation	x	See note below
Electronic alarm				
High temperature	Temperature of Electronics > reference value	Regular operation	x	Temperature correct
Low temperature	Temperature of Electronics < reference value	Regular operation	x	Temperature correct
Humidity	Humidity of Electronics > reference value	Regular operation	x	Humidity correct
Acceleration-x	Acceleration-x of Electronics > reference value	Regular operation	x	Acceleration correct
Acceleration-y	Acceleration-y of Electronics > reference value	Regular operation	x	Acceleration correct
Acceleration-z	Acceleration-z of Electronics > reference value	Regular operation	x	Acceleration correct
Memory-FL	Failure in writing the flash memory of ECU1000	Regular operation	x	Check of memory OK
Memory-NVR	Failure in writing the non-volatile ram of ECU1000	Regular operation	x	Check of memory OK
Characterization	Input characterization data wrong (n° points, incr/dec, monotonic)	Regular operation	x	Characterization data correct
Display card	The communication line between Base and Display cards is damaged	Regular operation	x	Communication correct

Time is set by the parameter "Time to reach posit." in the "Function block Actuator setup, Function TAB, Miscellaneous"

(1) **Stroke limit:** the Alarm exits if the Actuator Position % is % < "-STOP ZONE%" or > "100+STOP ZONE%". The actuator moves according to "position demand", it does not indicates "end of travel" and when position % is within the "STOP ZONE%" or "100+STOP ZONE%" the alarm disappears.

(2) **Fail to position:** the Alarm exits if:

- The ECU1000 works in remote control (auto or manual) or in ESD
- The position error is > 4% for a time greater than parameter "time to position"
- The actuator is not closed and the command is "close" or the actuator is not open and the command is "open".
- Reset of alarm "Fail to position":
 - in remote auto : position error < 4%
 - in remote manual by a new open/close manual command or if position % is less than 4% from open and close limit
 - in ESD by removing ESD command or position % within 4% of ESD position

The maximum out of positioning function is 50%

The alarm is not generated in local control and configuration mode.

(3) On request ECU1000 can be set to initiate the **Failsafe** action or to activate the "Stay in position by optional SOV" function in case of "Fail to position"

(4) **Hyd. Valve Leak:** The alarm is available only in the "on-off actuator".

(5) **PWM Utilization %:** the alarm exits only if the ECU1000 is provided with **PWM driver** and the actuator is controlled by PSOV's or modulating proportional valve without spool feedback. When alarm is active the maximum duty of PWM signal is **lowered** until the alarm disappears. It is a protection of proportional valve /PSOV from over-heating in case of heavy service (see description of alarm in the DTDE328)

ECU 1000 Control functions and Local Operator Interface

15.3 Additional Alarm table (NAMUR NE107: OUT of SPEC)

The following table includes the alarms present only if the relevant function is active. See DTDE328 for the instruction of PST and HPU.

Name	Description	Actuator operation	Pump control	Alarm	Alarm reset
Alarm of PST					
PST T-PST	T-PST time % greater than T-PST of signature	Regular operation		x	New PST or Clear Failure/Alarm
PST OV-TR	OV-TR % greater than configured value	Regular operation		x	New PST or Clear Failure/Alarm
PST T-RET	T-RET time % greater than T-RET of signature	Regular operation		x	New PST or Clear Failure/Alarm
PST Reset	PST cycle aborted	Regular operation		x	New PST or Clear Failure/Alarm
Alarm of HPU (with 2 pumps)					
HPU pres. transm.	Oil pressure transmitter out of range	Regular operation (1)	Pump1 and 2 off	x	Correct range of signal
High oil pressure	Oil pressure > high pressure limit	Regular operation (1)	Pump1 and 2 off	x	Pressure < limit
Low oil pressure	Oil pressure < low pressure limit	Regular operation (1)	Regular operation	x	Pressure > limit
Oil level (low)	Oil level sensor = on	Regular operation (1)	Pump1 and 2 off	x	Level switch off
Oil temper. (high temperature)	Oil thermostat = on	Regular operation (1)	Pump1 and 2 off	x	Thermostat off
HPU gener. sens.	General on-off sensor of HPU = on	Regular operation (1)	Pump1 and 2 off	x	General on-off sensor in off
Hand-pump	Hand-pump engaged	Tracking (1)	Regular operation	x	Hand-pump disengaged
Max start D-SOV	Starts of Discharge SOV (D-SOV) > reference	Regular operation	Regular operation	x	Clear counter command
HPU sign sw	HPU signalling on-off sensor	Regular operation	Regular operation	x	HPU on-off sensor in off
Alarm of PUMP1					
Pump1 power sup (electrical power)	Loss of power supply of pump1 motor	Regular operation (1)	Pump1 off , switch to pump2 (2)	x	Electrical power of pump1 correct
Pump1 mot. TH	Motor thermostat of pump1=on	Regular operation (1)	Pump1 off , switch to pump2 (2)	x	Motor thermostat of pump1 off
Pump1 filter	Oil filter sensor=on	Regular operation (1)	Pump1 off , switch to pump2 (5)	x	Oil filter sensor of pump1 off
Gener. sens. pump1	General on-off sensor of pump1=on	Regular operation (1)	Pump1 off , switch to pump2 (2)	x	General sensor of pump1 off
Max time pump1	Max time to reach the pressure (pump1)	Regular operation (1)	Pump1 off , switch to pump2 (3)	x	Clear alarm cmd or pressure is correct
Max start pump1	Starts of motor of pump1 > reference	Regular operation	Pump1 off , switch to pump2 (4)	x	Clear counter command
Alarm of PUMP2					
Pump2 power sup. (electrical power)	Loss of power supply of pump2 motor	Regular operation (1)	Pump2 off , switch to pump1 (2)	x	Electrical power of pump2 correct
Pump2 mot. TH	Motor thermostat of pump2=on	Regular operation (1)	Pump2 off , switch to pump1 (2)	x	Motor thermostat of pump2 off
Pump2 filter	Oil filter sensor=on	Regular operation (1)	Pump2 off , switch to pump1 (5)	x	Oil filter sensor of pump2 off
Gener. sens. pump2	General on-off sensor of pump2=on	Regular operation (1)	Pump2 off , switch to pump1 (2)	x	General sensor of pump2 off
Max time pump2	Max time to reach the pressure (pump2)	Regular operation (1)	Pump2 off , switch to pump1 (3)	x	Clear alarm cmd or pressure is correct
Max start pump2	Starts of motor of pump2 > reference	Regular operation	Pump2 off , switch to pump2 (4)	x	Clear counter command

The HPU and pump alarms exit only if the pump is provided with the relevant sensors (for instance if the HPU is without oil level sensor, the "Oil level" alarm cannot exit)

(1) In the default configuration the ECU1000 signals ALARM. On request ECU1000 can be set to signal "FAILURE" due to "HPU failure" (see "Failure table" in DTDE327 and "HPU control" in DTDE328).

(2) If both pumps are in Alarm both **Pumps are off**.

(3) If the alarm occurs the running pump switches to off and the second pump starts. If the alarm occurs also with the second pump, "the motor stops" or "the motor runs" according to the configuration of the ECU1000.

(4) If both pumps are in "Max start alarm" the running pump continues to work.

(5) If both pumps are in "Pump filter" alarm the running pump continues to work.

ECU 1000 Control functions and Local Operator Interface

Name	Description	Actuator operation	Pump control	Alarm	Alarm reset
Alarm of HPU (with 1 pump)					
HPU pres. transm.	Pressure transmitter of HPU signal out of range	Regular operation (1)	Pump1 off	x	Correct range of signal
High oil pressure	Oil pressure > high pressure limit	Regular operation (1)	Pump1 off	x	Pressure < limit
Low oil pressure	Oil pressure < low pressure limit	Regular operation (1)	Regular operation	x	Pressure > limit
Oil level (low)	Oil level sensor = on	Regular operation (1)	Pump1 off	x	Level switch off
Oil temper. (high temperature)	Oil thermostat = on	Regular operation (1)	Pump1 off	x	Thermostat off
HPU gener. sens.	General on-off sensor of HPU = on	Regular operation (1)	Pump1 off	x	General on-off sensor in off
Hand-pump	Hand-pump engaged	Tracking (1)	Regular operation	x	Hand-pump disengaged
Max start D-SOV	Starts of Discharge SOV (D-SOV) > reference	Regular operation	Regular operation	x	Clear counter command
HPU sign sw	HPU signalling on-off sensor	Regular operation	Regular operation	x	HPU on-off sensor in off
Alarm of PUMPI					
Pump1 power sup (electrical power)	Loss of power supply of pump1 motor	Regular operation (1)	Pump1 off	x	Electrical power of pump1 correct
Pump1 mot. TH	Motor thermostat of pump1=on	Regular operation (1)	Pump1 off	x	Motor thermostat of pump1 off
Pump1 filter	Oil filter sensor=on	Regular operation (1)	Regular operation	x	Oil filter sensor of pump1 off
Gener. sens. Pump1	General on-off sensor of pump1=on	Regular operation (1)	Pump1 off	x	General sensor of pump1 off
Max time pump1	Max time to reach the pressure (pump1)	Regular operation (1)	Pump1 off or run (2)	x	Clear alarm cmd or pressure is correct
Max start pump1	Starts of motor of pump1 > reference	Regular operation	Regular operation	x	Clear counter command

The HPU and pump alarms exit only if the pump is provided with the relevant sensors (for instance if the HPU is without oil level sensor, the “Oil level” alarm cannot exit)

(1) In the default configuration the ECU1000 signals ALARM. **On request** ECU1000 can be set to signal “FAILURE” due to “HPU failure” (see “Failure table” in DTDE327 and “HPU control” in DTDE328).

(2) The pump control can be configured to “the motor stops” or “the motor runs” when the alarm occurs.

15.4 Remote not available table (NAMUR NE107: FUNCTION CHECK)

Name	Description	Actuator status	Remote control not available
Configuration	Configuration mode	Stay in position	x
Local	Actuator in local control	Regular operation by local manual control	x
Hand-pump	Hand-pump engaged	Tracking	x

15.5 Maintenance required table (NAMUR NE107: MAINTENANCE REQUIRED)

Name	Description	Actuator operation	Maintenance Requir. status
Expired maintenance date	Present date > reference date (maintenance request date)	Regular operation	x

16 Loggers

The manual **DTDE328** provides the instructions to use the Logger feature. The present paragraph gives only a brief description of the main features of logger function. The ECU1000 has the following separated logger:

- **Event logger:** it contains the list of the last 256 events. Each event is described by type, date and action
- **Failure logger:** it contains the list of the last 256 failures. Each failure is described by type and date
- **Alarm logger:** it contains the list of the last 256 alarms. Each alarm is described by type and date
- **Statistic log:** it contains statistic data and counters

The tables with the list of **Failures** and **Alarms** are reported in the paragraph “**Actuator malfunction tables**”. The following tables show the list of **Event and Statistic logger**:

Event	Description
Power on	Main voltage on and external watch-dog OK
Remote-man	Remote manual cmd
Local-cmd	Local manual cmd (from display card or serial)
Bus-man	Manual cmd from bus
ESD	ESD cmd
Limit calib.	Limit calibration
Failsafe	Failsafe function active
Demand<5>95%-hw	Demand >95% or <5%, from remote hw, hysteresis 10%
Demand<5>95%-bus	Demand >95% or <5%, from bus, hysteresis 10%
Demand<5>95%-loc	Demand >95% or <5%, from local, hysteresis 10% (from display card or serial)
PST	PST cmd
Configuration	Configuration status
Interlock	Interlock function active
Restore config.	Restore configuration cmd
Full default	Full default cmd
Tracking	Tracking status
CRC Memory-EE	Check of memory-EE
CRC Memory-FL	Check of memory-FL
CRC Memory-NVR	Check of memory-NVR
Pump1-2 switch	Switch of pumps (pump1-2 or pump2-1)

The data of loggers are saved in the permanent memory of ECU1000, and maintained in the memory even if the electrical power fails. When the memory is full and a new event, failure or alarm occurs the oldest one is deleted and the new one is entered.

The loggers can be viewed only by **BIFFI-Assistant SW** tool since the view area of local display is small.

The **short logger** allows viewing only the last 10 events, failures or alarms to speed-up the read operation from ECU1000.

Statistics	Description
Max temperature	Highest temperature of ECU1000 in °C
Min temperature	Lowest temperature of ECU1000 in °C
Pump1 start	Number of starts of pump1 (only with HPU and pump1)
Pump1 run time	Run time of pump1 in hours (only with HPU and pump1)
Pump2 start	Number of starts of pump2 (only with HPU and pump2)
Pump2 run time	Run time of pump2 in hours (only with HPU and pump2)
HPU D.SOV start	Number of starts of DSOV of HPU (only with HPU and DSOV)
EV1 max utilization%	Highest value of EV1 PWM utilization% (only with PWM module)
EV2 max utilization%	Highest value of EV2 PWM utilization % (only with PWM module)

Statistic log is not available in the short logger

17 Graphs and Recorder

The manual **DTDE328** gives the instructions to use the Graph and Recorder functions. The present paragraph gives only a brief description of the main features of **graph and recorder**. By the **Recorder** function, the ECU1000 can save in its permanent memory the last **5 curves** and **1 signature** for each one of the following options:

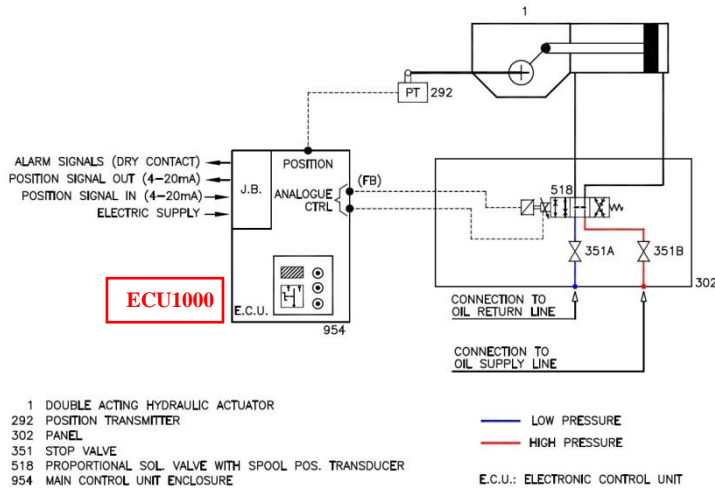
- Opening curve (OP-stroke)
- Closing curve (CL-stroke)
- Record curve
- PST curve (if the function is active)

The data are maintained in the memory even if the electrical power fails. When the memory is full and a new curve is available the oldest one is deleted and the new one is entered. Each curve can save up to **4 variables**. Each curve consists in **200 samples** of each selected variables. The curves can be viewed and exported only by **BIFFI-Assistant SW** tool.

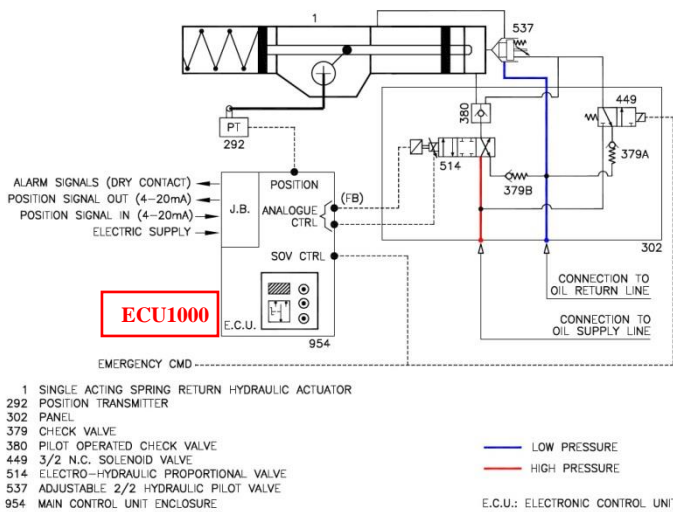
18 Examples of modulating actuators

18.1 Actuator for heavy modulating service

The figures below show the operating principle.



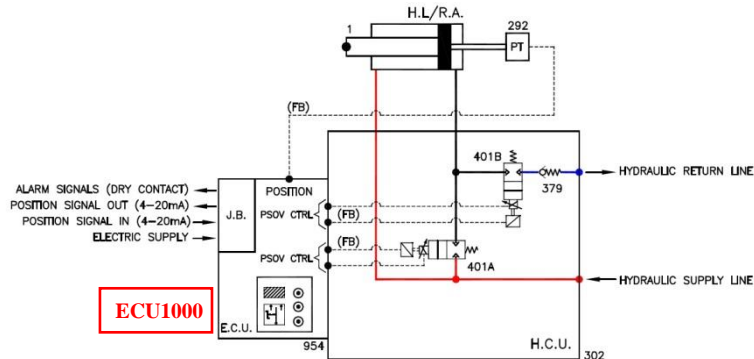
Double acting actuator for heavy modulating service



Single acting spring return actuator for heavy modulating service and additional SOV for emergency command

18.2 Actuator for heavy modulating service and low oil drain

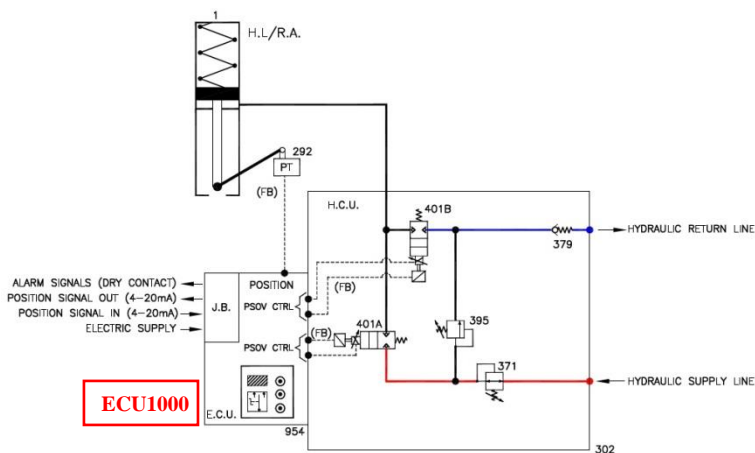
The figures below show the operating principle.



Double acting actuator for heavy modulating service, stay in position in case of loss of electrical power

- 1 DOUBLE ACTING HYDRAULIC LINEAR ACTUATOR
- 292 POSITION TRANSMITTER
- 302 PANEL
- 379 CHECK VALVE
- 401 2/2 N.C. POPPET TYPE PROP. VALVE WITH SPOOL POS. TRANSDUCER
- 954 MAIN CONTROL UNIT ENCLOSURE

- LOW PRESSURE
- HIGH PRESSURE
- H.L./R.A.: HYDRAULIC LIN./ROT. ACTUATOR
- H.C.U.: HYDRAULIC CONTROL UNIT
- E.C.U.: ELECTRONIC CONTROL UNIT



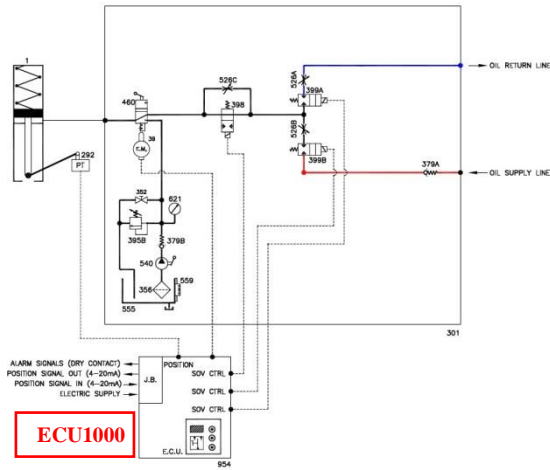
Single acting spring return actuator for heavy modulating service, stay in position in case of loss of electrical power

- 1 SINGLE ACTING HYDRAULIC LINEAR ACTUATOR
- 292 POSITION TRANSMITTER
- 302 PANEL
- 371 HYDRAULIC PRESSURE REGULATOR
- 379 CHECK VALVE
- 395 RELIEF VALVE
- 401 2/2 N.C. POPPET TYPE PROP. VALVE WITH SPOOL POS. TRANSDUCER
- 954 MAIN CONTROL UNIT ENCLOSURE

- LOW PRESSURE
- HIGH PRESSURE
- H.L./R.A.: HYDRAULIC LIN./ROT. ACTUATOR
- H.C.U.: HYDRAULIC CONTROL UNIT
- E.C.U.: ELECTRONIC CONTROL UNIT

18.3 Actuator for stepping modulating service

The figures below show the operating principle

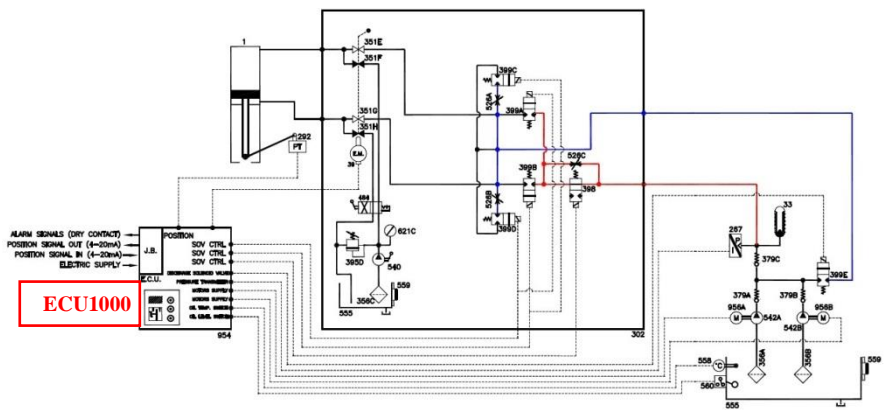


Single acting spring return actuator for modulating service, 2 SOV's to open/close the actuator, one fast/slow speed SOV, manual pump with selector.

- 1 SINGLE ACTING SPRING RETURN HYDRAULIC ACTUATOR
- 39 SIGNALLING MICROSWITCH
- 292 ELECTRIC POSITION TRANSMITTER
- 302 PANEL
- 352 NEEDLE VALVE
- 356 HYDRAULIC FILTER
- 379 CHECK VALVE
- 398 2/2 N.O. POPPET TYPE SOLENOID VALVE
- 399 2/2 N.C. POPPET TYPE SOLENOID VALVE
- 526 BIDIRECTIONAL FLOW REGULATOR (ADJUSTABLE SETTING)
- 540 HANDPUMP
- 555 OIL TANK
- 559 LEVEL GAUGE
- 621 PRESSURE GAUGE
- 954 MAIN CONTROL UNIT ENCLOSURE

— LOW PRESSURE
— HIGH PRESSURE
E.C.U.: ELECTRONIC CONTROL UNIT

Double acting actuator for modulating service, 4 SOV's to open/close the actuator and one fast/slow speed SOV, integral HPU with dual motor pump, manual pump



- 1 DOUBLE ACTING HYDRAULIC LINEAR ACTUATOR
- 33 HYDRAULIC ACCUMULATOR (BLADDER TYPE)
- 39 SIGNALLING MICROSWITCH
- 287 PRESSURE TRANSMITTER
- 292 POSITION TRANSMITTER
- 302 PANEL
- 351 STOP VALVE
- 356 HYDRAULIC FILTER
- 379 CHECK VALVE
- 398 RELIEF VALVE
- 398 2/2 N.O. POPPET TYPE SOLENOID VALVE
- 399 2/2 N.C. POPPET TYPE SOLENOID VALVE
- 484 4/2 HAND ACTUATED VALVE
- 526 BIDIRECTIONAL FLOW REGULATOR (ADJUSTABLE SETTING)
- 540 HANDPUMP
- 542 HYDRAULIC ROTATING PUMP
- 555 OIL TANK
- 558 ELECTRIC TEMPERATURE SWITCH
- 559 LEVEL GAUGE
- 560 ELECTRIC LEVEL SWITCH
- 621 PRESSURE GAUGE
- 954 MAIN CONTROL UNIT ENCLOSURE
- 956 ELECTRIC MOTOR

— LOW PRESSURE
— HIGH PRESSURE
E.C.U.: ELECTRONIC CONTROL UNIT

19 Local Operator Interface

19.1 Description

The **Local Operator Interface** allows

- Selection between LOCAL and REMOTE control
- Local control of actuator to drive the valve in opening and closing direction
- Navigation in the menu to
 - view the working parameters
 - modify the working parameters
 - send commands to electronics and actuator to execute calibration procedures and operations on data stored in the memory
 - to view the value of the working variables (position, temperature, pressure, status, etc)
 - to view the present “Failure” and “Alarm”
 - to view the “Function summary”
 - to clear the Failure and Alarm

It consists in:

- Two bi-coloured green/red LED’s to indicate the following status: open / opening, closed / closing, stop in intermediate position.
 - The LED indicating open/opening is green and the one indicating closed/closing is red. The colour can be changed to red and green by the setting operation in the menu
 - If one LED flashes, the actuator moves in the direction of flashing LED
 - If both LED’s are on the actuator is not moving
 - If one LED is on and the second one is off, the actuator is fully open or fully closed
- One bi-coloured yellow/red LED to indicate the following status: failure, alarm (out of specification). The standard configuration is yellow. The colour can be changed to red by the setting operation in the menu
 - Failure = LED on
 - Alarm = LED flashing
- One blue LED to indicate connection to PC via Bluetooth
- 1 graphic **OLED** display, 64x128 dots. When actuator is powered the display shows the “**HOME VIEW**” that collects the most important data relevant to actuator (position, status, etc.) in one only view.
- 3 push-buttons **UP/OPEN**, **DOWN/CLOSE**, **ENTER** with double function
 - In MENU operation: UP and DOWN move the cursor and increase / decrease the value of selected variable
 - In LOCAL control mode: OPEN and CLOSE drive the actuator in opening and closing direction
- 1 optional two position LOCAL/REMOTE selector
- On demand the Local Operator Interface can be provided with 8 additional LED’s. The conditions to switch-on the LED’s are configurable by the menu options.

REMOTE, LOCAL, CONFIGURATION operations:

- LOCAL: the actuator can be moved by means of pushbuttons UP/OPEN, DOWN/CLOSE
- REMOTE: the actuator is under control of signals coming from control room
- CONFIGURATION: the actuator stays in position. It is possible to modify the working parameters and send commands to Electronics of ECU1000



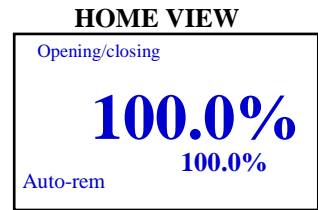
Display of Local Operator Interface

ECU 1000 Control functions and Local Operator Interface

Navigation in the menu:

It is allowed only in REMOTE by means of the local pushbuttons ENTER, UP/OPEN, DOWN/CLOSE

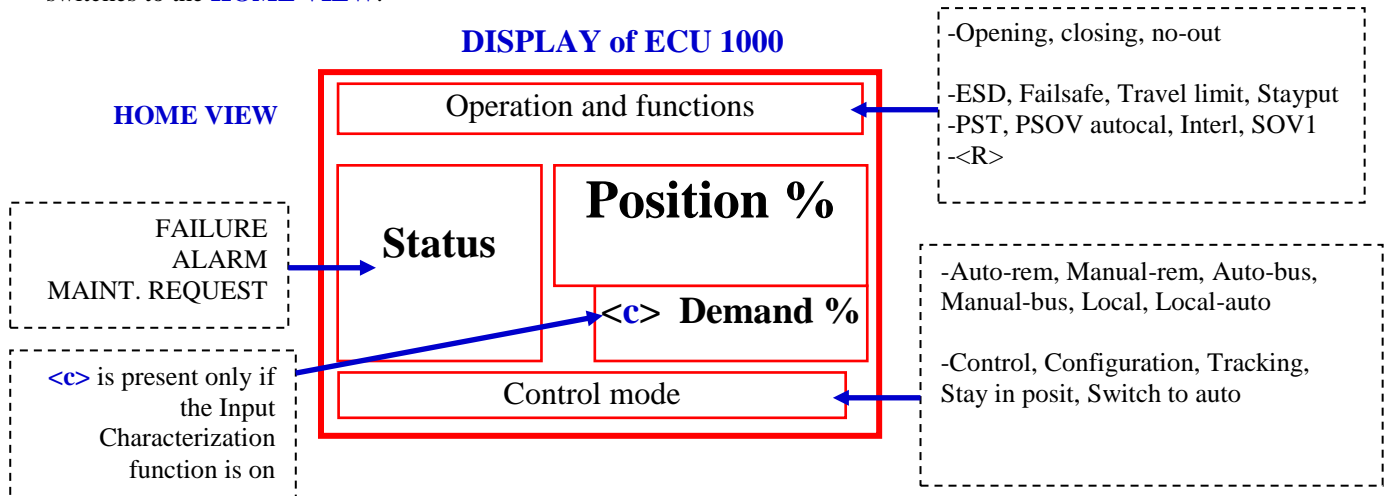
- **ENTER:** it allows switching to the next level of menu of the selected line. It allows to return to previous level of menu if the cursor is on “..” line. The same operation can be done by pushing simultaneously UP and DOWN.
- **UP or DOWN:** they allow moving the cursor and select the lines of menu. The selected line is shown in reversed mode.
- **DOWN:** if the display shows the HOME VIEW, it allows viewing data and status of actuator



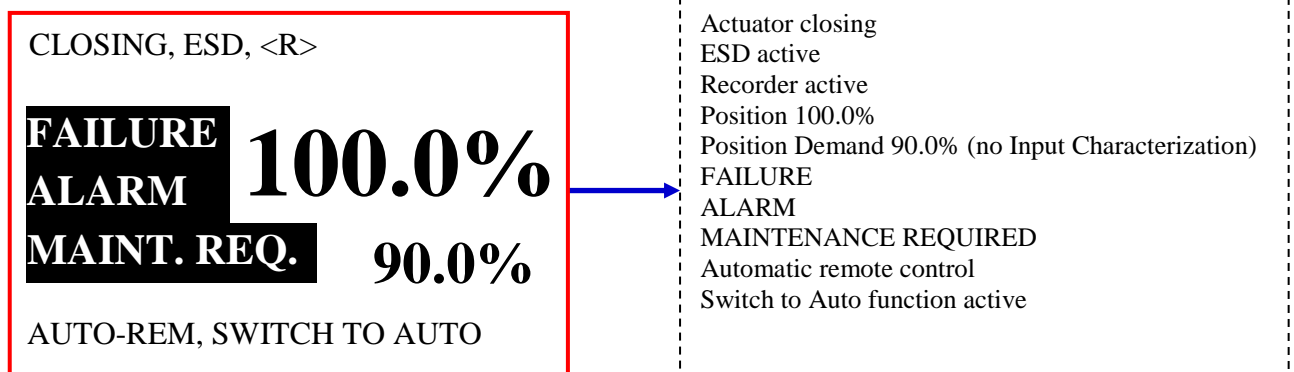
The next paragraphs describe the procedures to navigate in the menu and to switch in local control with the options:

- only pushbuttons UP/OPEN, DOWN/CLOSE, ENTER
- pushbuttons UP/OPEN, DOWN/CLOSE, ENTER and optional selector LOCAL/ REMOTE

When ECU 1000 is powered, the microcontroller executes the initialization routine to check the memory, set I/O's, read data, etc. The display shows the message “> Connection...”. When the initialization procedure ends the display switches to the **HOME VIEW**.



Example of **HOME VIEW**

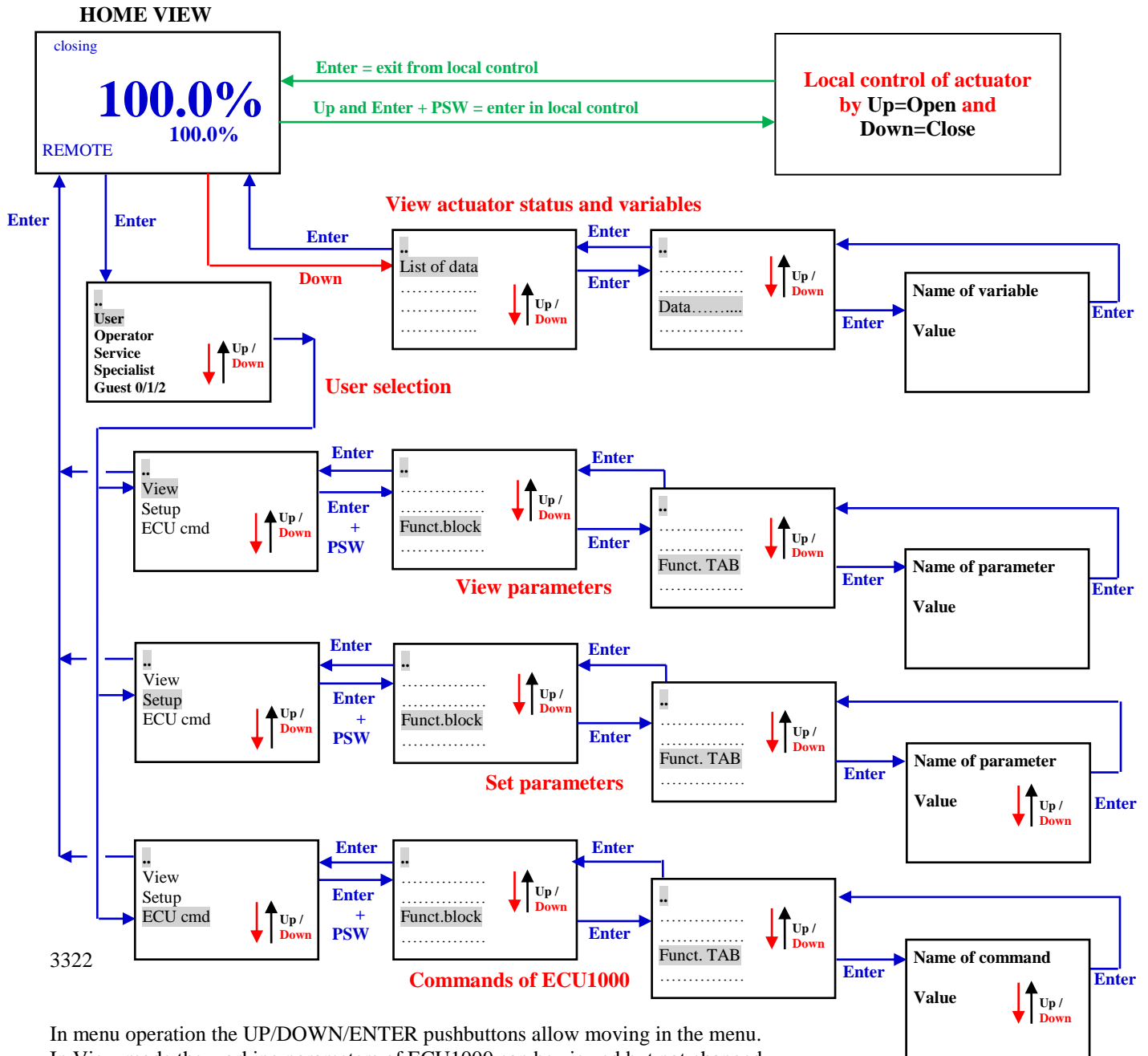


The ECU 1000 automatically returns to HOME VIEW if no local pushbutton is used in 10 min.

If the actuator is for on-off service the “Demand%” is not present on the local display.

19.2 Pushbuttons UP, DOWN, ENTER

The figure below shows the menu chart. To enter in LOCAL control mode, press UP and then ENTER, maintaining UP pressed. Then enter the password (at least level 1, User). In local control mode the navigation in the menu is not allowed since UP and DOWN pushbuttons work as OPEN and CLOSE commands to open and close the valve. The LOCAL control status is saved in the permanent memory of the Electronics. If the actuator is switched off, it will restart in LOCAL. To exit from LOCAL it needs to press ENTER.



In menu operation the UP/DOWN/ENTER pushbuttons allow moving in the menu.

In View mode the working parameters of ECU1000 can be viewed but not changed

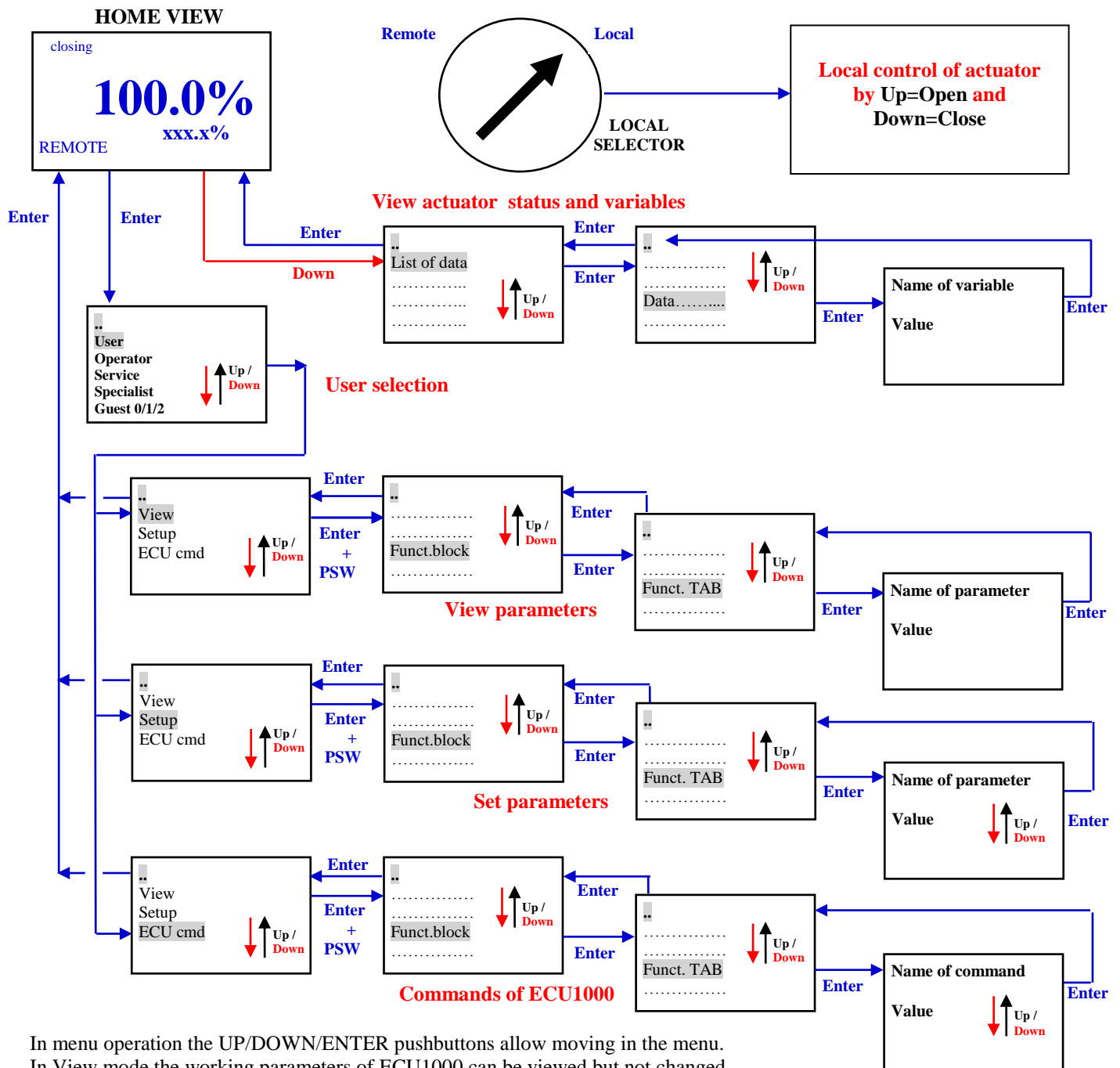
In Setup mode the working parameters of actuator can be viewed and changed

In ECU cmd mode it is possible to activate commands to calibrate analogue inputs and outputs, set travel limits, set memory, save configuration data, view variables, etc.

Note: it needs to press one time UP or DOWN or ENTER to wake up the display before initiating menu operation. This is due to the display function “auto or save”.

19.3 Push-buttons UP, DOWN, ENTER and two-position selector

- On demand the local operator interface can be provided with a local two-position selector LOCAL, REMOTE
- Switch from LOCAL to REMOTE control mode is done by selector, password is not required
 - Navigation in the menu is not allowed if selector is in LOCAL
 - In LOCAL the actuator can be moved by means of pushbuttons UP/OPEN, DOWN/CLOSE.
 - In REMOTE the actuator is under control of signals of control room



In menu operation the UP/DOWN/ENTER pushbuttons allow moving in the menu.

In View mode the working parameters of ECU1000 can be viewed but not changed

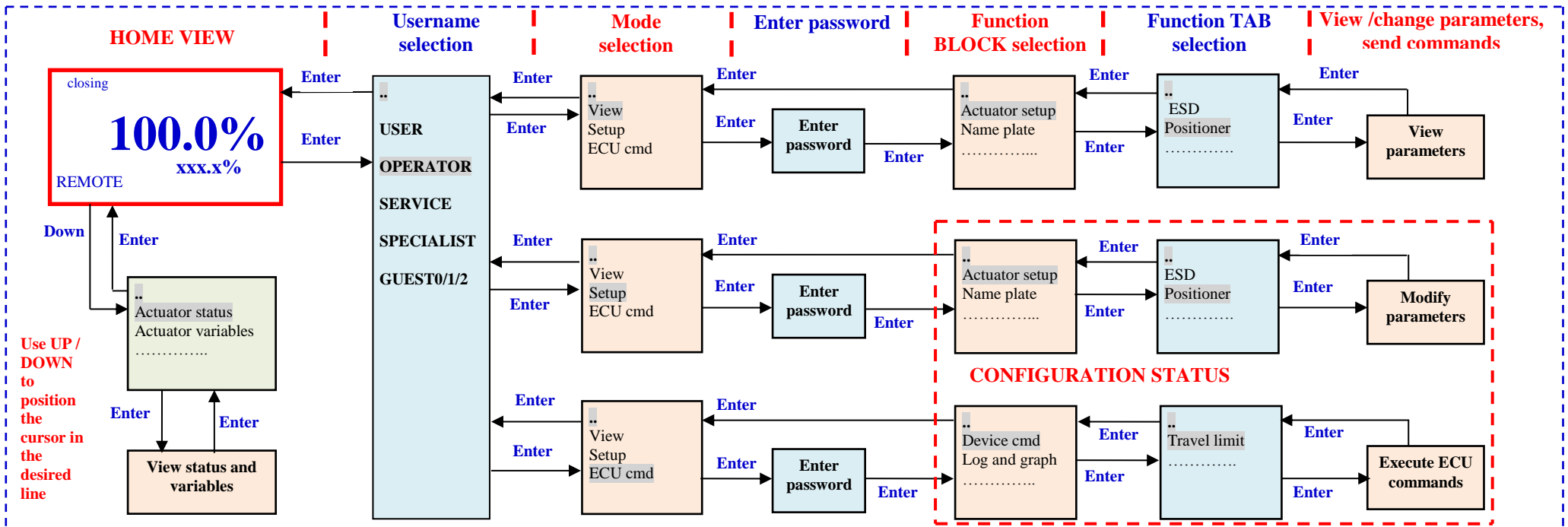
In Setup mode the working parameters of actuator can be viewed and changed

In ECU cmd mode it is possible to activate commands to calibrate analogue inputs and outputs, set travel limits, set memory, save configuration data, view variables, etc.

Note: it needs to press one time UP or DOWN or ENTER to wake up the display before initiating menu operation. This is due to the display function “auto or save”.

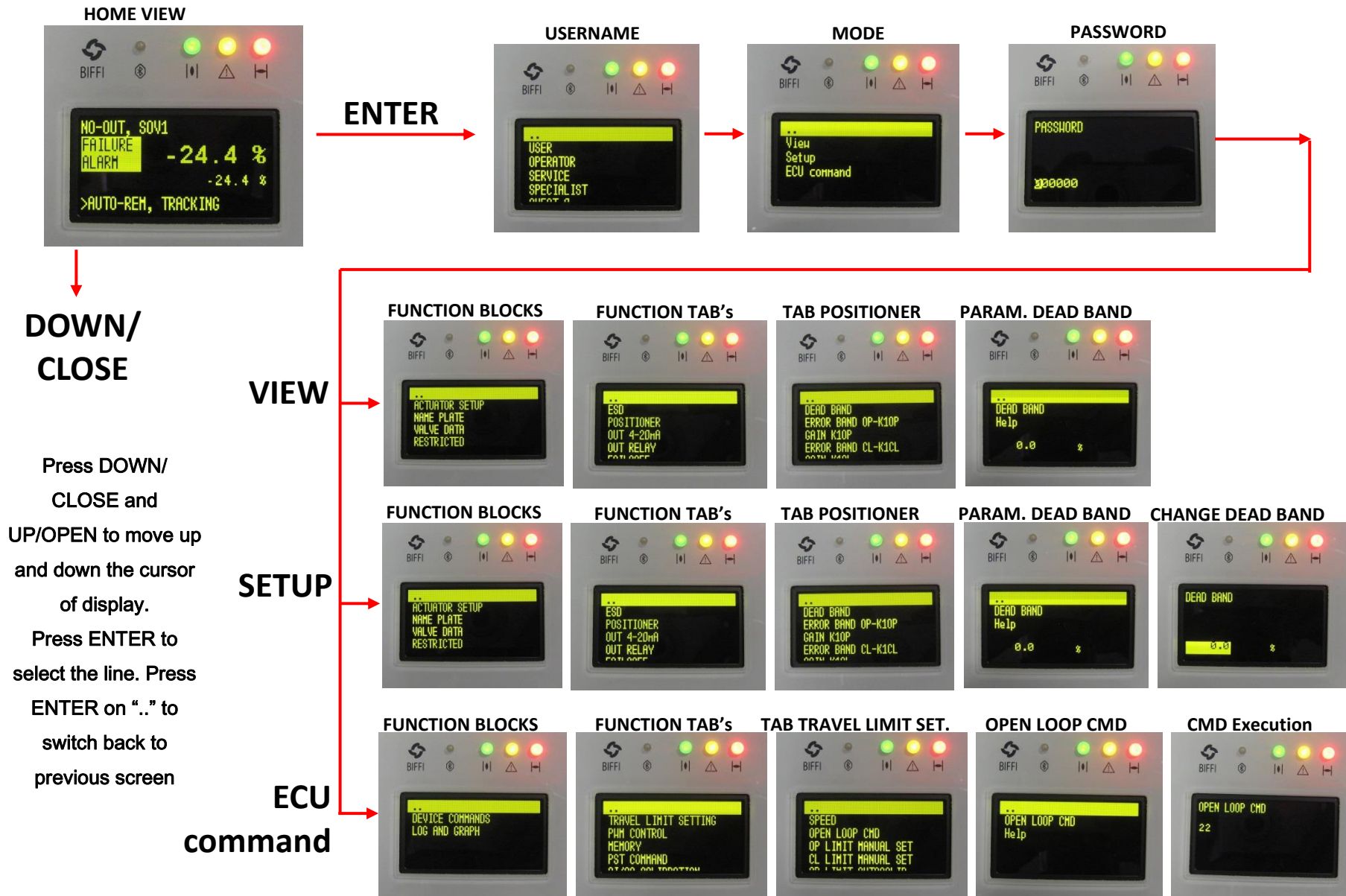
ECU 1000 Control functions and Local Operator Interface

19.4 ECU1000 menu



To view/modify a parameter or send an ECU command from the HOME VIEW it needs: to select the username, to select the mode, to enter the password, to select the Function Block, to select the Function TAB, to select the parameter or ECU command.

ECU 1000 Control functions and Local Operator Interface



ECU 1000 Control functions and Local Operator Interface



ECU 1000 Control functions and Local Operator Interface

In **View mode** the working parameters of ECU1000 can be viewed but not changed. In **Setup mode** the working parameters of actuator can be viewed and changed. In **ECU cmd mode** it is possible to send commands to ECU1000 (to calibrate analogue inputs and outputs, set travel limits, set memory, save configuration data, view variables, etc.). The access to View, Setup and ECU cmd menus depends on the **username and password level**. 4 password levels are available; each password is 6 char long (number or capital letters). Three additional passwords allow special operations. Username and password work as described below:

- Username **USER**: only parameters of **active functions** with password **level 1** can be viewed and modified; only ECU cmd's of **active functions** with password **level 1** can be executed. The default password is "**100000**". It is configurable and allows modifying few parameters (Dead band, Recorder, output relay, etc.). Disabled functions and ECU cmd's cannot be viewed.
- Username **OPERATOR**: only parameters of **active functions** with password **levels 1 and 2** can be viewed and modified; only ECU cmd's of **active functions** with password **level 1 and 2** can be executed. The default password is "**200000**". It is configurable and allows commissioning the actuator (positioner, ESD, status relay, travel limit calibration, etc.). Disabled functions and ECU cmd's cannot be viewed.
- Username **SERVICE**: only parameters of **active functions** with password **levels 1, 2 and 3** can be viewed and modified; only ECU cmd's of **active functions** with password **level 1, 2 and 3** can be executed. Disabled functions and ECU cmd's cannot be viewed.
- Username **SPECIALIST**: this password (**level 4**) allows viewing/modifying any parameter of **active functions** and executing any ECU cmd of **active functions**. Disabled functions and ECU cmd's cannot be viewed.
- Username **GUEST0**: it allows viewing the **full set of parameters and ECU commands**, including the parameters and ECU commands of the non-active functions. **No write** operation is allowed. The GUEST0 password is "**10000A**".
- Username **GUEST1**: it allows only viewing the NAME PLATE function block. **No write** operation is allowed. The GUEST0 password is "**A0000A**".
- Username **GUEST2**: it has the same permits of the SPECIALIST, but the number of access to ECU1000 menu is limited to 10. After 10 accesses the password is no longer valid.

Passwords of SERVICE, SPECIALIST, and GUEST2 are reserved to product specialist.

The menu is organized in "**Function block**", "**Function TAB**", "**Parameter and Command**".

Each "**Function TAB**" collects a group of "**Parameters or ECU Commands**", each "**Function block**" collects a group of "**Function TAB's**". Only the parameters and commands with username levels lower or equal to entered username level can be viewed and modified. Parameters and functions not enabled will not be shown (except username GUEST0)

The paragraph "**Parameter table**" shows the table of the FUNCTION BLOCKS, FUNCTION TAB's and PARAMETERS, the description of each PARAMETER and the **PSW level required**.

The paragraph "**ECU cmd table**" shows the table of the FUNCTION BLOCKS, the FUNCTION TAB's and COMMANDS, the description of each "ECU command" and the PSW level required.

The paragraph "**Status and variables table**" shows the list of the status and variables visible on the display and useful for commissioning and diagnostic operations.

To access to parameters and ECU cmd's the following steps are required:

- Verify the PSW level required in the "Parameter and ECU cmd" tables
- Enter username and password
- Select the Function Block
- Select the Function TAB
- Select the parameter or ECU cmd
- View / change the parameter or execute the ECU cmd
- Exit from menu

ECU 1000 Control functions and Local Operator Interface

Function block	Function TAB	Parameter	Psw level
Actuator Setup			
	Failsafe		
	Function visible only if activated by the manufacturer	Action delay (0-100 sec)	1
		Action of actuator (off, tracking, stayput, go to position%)	2
		Position% (0-100 %)	2
	Miscellaneous		
	Value not visible Value not visible	Max time to position (1-255 sec)	1
		Bluetooth name (actuator serial number, valve tag, cabinet serial number)	1
		User password	1
		Operator password	2
		DL1 close colour (green, red)	1
		DL2 alarm colour (yellow, red)	1
		DL3 open colour (green, red)	1
	Date		
		Date and time (2010.01.01 to 2099.12.31)	1
		Start-up date (2010.01.01 to 2099.12.31)	1
		Maintenance request date (2010.01.01 to 2099.12.31)	1
	Pump control		
	Function visible only if activated by the manufacturer	Pump1 mode (auto, off)	2
		Pump stop delay (0-255 sec)	1
		Act ctrl delay (0-255sec) (after ECU1000 power on)	2
		Maximum time to pressure (0-255 min) (0= disable check of time)	2
		Pump2 mode (auto, off)	2
		Pump cycle (0-10000 h)	1
	Recorder		
		Recorder time (2,4,10,20,50,...,1000) (#)	1
		Stop condition (failure, alarm, position <5%, position >95%)	1
		Y-axis (position demand, position, HPU pressure, position error,etc.)	1
		Recorder mode (off, record, pst, op-curve, cl-curve, multi-stroke) (##)	1
		Recording Duration OP (2,4,10,20,50,...,1000) (###)	1
		Recording Duration CL (2,4,10,20,50,...,1000) (####)	1
		Recording Duration PST (2,4,10,20,50,...,1000) (#####)	1
	Input characterization		
	Function visible only if activated in the Restricted menu, Function selector. Only a number of points equal to "Custom point" is shown on the local display.	Input characteristic (off, linear 100-0, custom increase, custom decrease)	2
		Custom point (from 2 to 21)	2
		Input #0	2
		Output #0	2
		Input #1	2
		Output #1	2
		Input #2	2
		Output #2	2
		Input #3	2
		Output #3	2
		Input #4	2
		Output #4	2
		Input #5	2
		Output #5	2
		Input #6	2
		Output #6	2
		Input #7	2
		Output #7	2
		Input #8	2
		Output #8	2
		Input #9	2
		Output #9	2
		Input #10	2
		Output #10	2
		Input #11	2
		Output #11	2
	Input #12	2	
	Output #12	2	
	Input #13	2	
	Output #13	2	

(#): For FW version previous 2.001.000 and 3.001.00, it is the time duration of each curve (Record, PST, OP and CL) .

From FW 2.001.00 and 3.001.00, it is the duration time of the RECORD curve

(##): Multi-stroke option available from FW 2.001.000 and 3.001.000. It is equivalent to set pst, op-curve and cl-curve at the same time.

(###): Available from FW 2.001.000 and 3.001.000. It is the duration time of the OP curve

(####): Available from FW 2.001.000 and 3.001.000. It is the duration time of the CL curve

(#####): Available from FW 2.001.000 and 3.001.000. It is the duration time of the PST curve

ECU 1000 Control functions and Local Operator Interface

Function block	Function TAB	Parameter	Psw level	
Actuator Setup				
	Input characterization			
		Input #14		
		Output #14		
		Input #15	2	
		Output #15	2	
		Input #16	2	
		Output #16	2	
		Input #17	2	
		Output #17	2	
		Input #18	2	
		Output #18	2	
		Input #19	2	
		Output #19	2	
		Input #20	2	
		Output #20	2	
	PST setup	ID 1800		
	Function visible only if activated by the manufacturer	PST selector (disable, position, pressure1, pressure2, hpu oil pressure, temperature)	2	
		PST start (manual, auto, auto-manual)	2	
		PST period (in auto or auto-manual)	2	
		PST time (in auto or auto-manual)	2	
		PST travel	2	
		PST pause	2	
		Max T-PST (% of signature)	2	
		Max T-RET (% of signature)	2	
		Max OV-TRAV (% of position)	2	
		Max PST duration (sec)	2	
Name Plate				
	ECU1000 cabinet data			
		FW version display card (12 char)	1	
		FW version control card (12 char)	1	
Valve data				
	Valve data			
		Valve manufacturer (16 char)	1	
		Valve serial number (16 char)	1	
		Valve tag name (16 char)	1	
Restricted				
	Function selector			
		In characteriz (on/off)	2	
	Optional SOV1			
	Function activated by the manufacturer	Optional-SOV1 relay condition	2	
	Travel limit			
		Open limit mode (position, continuous, position change, cycle)	2	
		Close limit mode (position, continuous, position change, cycle)	2	

ECU 1000 Control functions and Local Operator Interface

19.6 ECU cmd table

The following table shows the commands of ECU 1000 available with password level 1 and 2, the Function TAB and Function BLOCK to which the commands belong and the password level required. The option “ECU cmd” allows executing the commands. Event logger, Failure logger, Alarm logger and curves are visible only by BIFFI-Assistant SW tool.

Function block	Function TAB	Command	Psw level		
Device cmd	Travel limit setting	Speed (output/speed % in travel limit setting, default 10%)	2		
		Open loop command	2		
		Op limit manual set (off, on)	2		
		Cl limit manual set (off, on)	2		
		Open limit autocalibration (on, off)	2		
		Close limit autocalibration (off, on)	2		
		Change open limit (0.0-5.0 %)	2		
		Change close limit (0.0-5.0)	2		
		SOV's control	Function visible only if activated by the manufacturer	PSOV's autocalibration (off, on)	2
				PSOV manual PWM (0-100 %)	2
				Drive PSOV (by UP and DOWN)	2
		PST command	Visible only if activated	PST start (off-on)	2
		Log and graph	Curves		
PST signature is available only if PST function is activate	Select opening signature			1	
Select closing signature	1				
Select recorder signature	1				
Select PST signature	1				

19.7 Status and variables table

The following table shows the list of data visible from the HOME VIEW by pressing DOWN. No PSW is requested. **Note:** it needs to press one time UP or DOWN or ENTER to wake up the display before initiating menu operation.

Description of data	Content
Actuator status: Output Position Status Operating mode Control type Control function	Opening, closing, no-out Open, closed, intermediate Normal, failure, alarm, maintenance required Control, configuration, tracking, stay in position, switch to auto Auto-rem, manual-rem, auto-bus, manual-bus, local, local auto ESD, Failsafe, travel limit, stayput, PST, PSOV autocal, Interl, SOV1
Actuator variables:	Position %, Position demand %, Position error %, In-pos demand %, Temperature °C, Humidity %, Acceleration-Xg-Yg-Zg, AO1 out %, Oil pressure bar, EV1 PWM%, EV2 PWM%, Next PST, Next pump switch, EV1-2 monitor, EV1-2 rate
Failure:	See list of failure in the paragraph “ Actuator malfunction tables”
Alarm:	See list of alarms in the paragraph “ Actuator malfunction tables”
Variables and counter:	Not used
Out relay status:	RI0,...RL10, off, on
Digital input (bit):	DI0,...DI10, EVPWR, 0, 1
Digital output (bit):	DO0 signal, DO1 signal, EV3 signal, 0, 1
Analogue input (bit):	AI0, AI1, AI2, AI3, AI4, HW-rev-ctrl, Temperature, Humidity, Acceleration-X-Y-Z, HW-rev-base, AI5 EV1 lift, AI6 EV2 lift
Analogue output (bit):	AO0, AO1
Bus status	Not available
Clear Failure / Alarm	It clears the list of failures and alarm. It can be used only for test operation since if a failure/alarm is present it will still appear in the list.
Function summary	The ECU1000 functions are enabled by the manufacturer according to the actuator/HPU/HCU to control. The end user can only change the parameters of each function to optimize the features of system. The command “ Function summary ” allows viewing the status (enabled/disabled) of the functions and their main characteristics.

20 Examples of menu operations

The following paragraph shows some example of operation with the ECU1000 menu.

Use UP and DOWN to select the line of display or to change the value of parameter. Use ENTER to confirm the value of parameter and to move to next menu. Select the line “..” and press ENTER to return to previous menu. The selected line of display is shown in reversed mode.

Press UP or DOWN or ENTER to wake up the ECU1000 display before initiating menu operation.

20.1 Username and password

The following example shows the procedure to enter username and password, to view / change parameter or execute an ECU cmd, to exit from menu operation and return to HOME VIEW.

- Press ENTER
- By UP and DOWN select the **username** and then press ENTER. The option available are “User”, “Operator” “Service”, “Specialist”, “Guest 0/1/2”
- By UP and DOWN select “View” or “Setup” or “ECU cmd”, then press ENTER.
- Enter the password. By UP and DOWN select the first character of password, then press ENTER to confirm.
- Repeat the above procedure and enter further 5 characters one at a time. Use number or capital letter.
- If password is not according to username the access to menu is not allowed. The display shows the previous option (selection of username). If password is correct the menu shows the list of Function Block available, according to password level and username.
- By UP and DOWN select the Function Block and then press ENTER.
- By UP and DOWN select the Function TAB and then press ENTER.
- By UP and DOWN select the parameter or the ECUcmd, then press ENTER.
- By UP and DOWN view / change the parameter or execute the ECUcmd, then press ENTER.
- By UP and DOWN select “..” and then press ENTER, to return to previous level of menu. Alternatively press simultaneously UP and DOWN.
- Repeat the above step until the HOME VIEW appears.

20.2 Parameter change

The example shows the procedure to change the value of DEAD BAND. Check the parameter table. The parameter DEAD BAND is in the Function Block “Actuator Setup” and in the Function TAB “Positioner”. The minimum password level requested is 1, associated to username “USER”.

- Press ENTER
- By UP and DOWN select the **username** and then press ENTER. The option available are “User”, “Operator” “Service”, “Specialist”, “Guest 0/1/2”
- By UP and DOWN select “**Setup**” and then press ENTER.
- Enter the password. By UP and DOWN select the first character of password, then press ENTER to confirm.
- Repeat the above procedure and enter further 5 characters one at a time. Use number or capital letter.
- If password is not according to username the access to menu is not allowed. The display shows the previous option (selection of username). If password is correct the menu shows the list of Function Block available, according to password level and username.
- By UP and DOWN select the Function Block “Actuator Setup” and then press ENTER.
- By UP and DOWN select the Function TAB “Positioner” and then press ENTER.
- By UP and DOWN select the parameter “DEAD BAND” and then press ENTER. Select “Help” to have additional information about the parameter. Press ENTER to exit from “Help”.
- By UP and DOWN increase / decrease the value and then press ENTER to set the new value.
- The cursor of display is on the line “..”. Press ENTER to return to the previous level of menu.
- By UP and DOWN select “..” and then press ENTER to return to previous level of menu. Alternatively press simultaneously UP and DOWN.
- Repeat the above step until the HOME VIEW appears.

20.3 Parameter visualization

The example shows the procedure to view the value of DEAD BAND. Check the parameter table. The parameter DEAD BAND is in the Function Block “Actuator Setup” and in the Function TAB “Positioner”. The minimum password level requested is 1, associated to username “USER”.

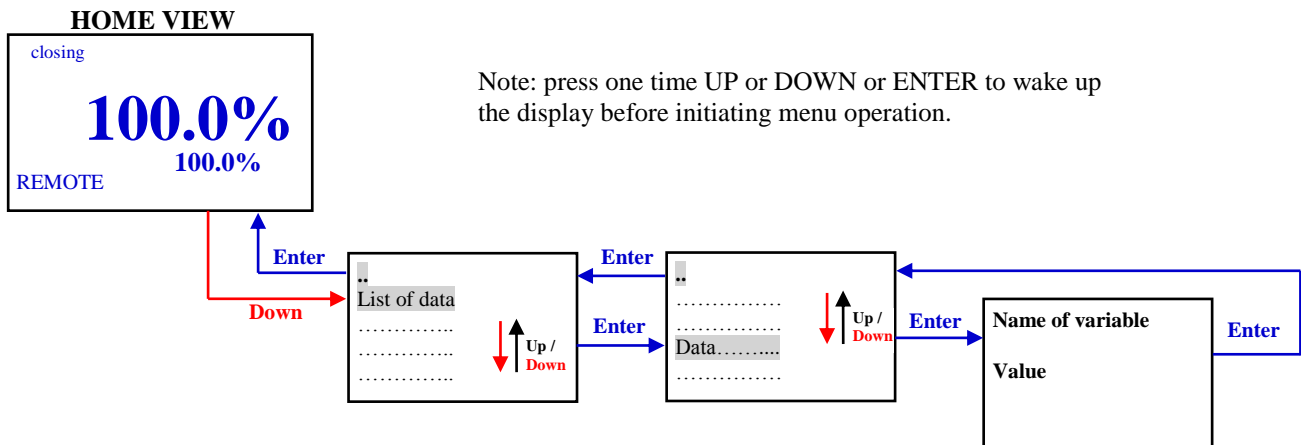
- Press ENTER
- By UP and DOWN select the **username** and then press ENTER. The option available are “User”, “Operator” “Service”, “Specialist”, “Guest 0/1/2”
- By UP and DOWN select “**View**” and then press ENTER.
- Enter the password. By UP and DOWN select the first character of password, then press ENTER to confirm.
- Repeat the above procedure and enter further 5 characters one at a time. Use number or capital letter.
- If password is not according to username the access to menu is not allowed. The display shows the previous option (selection of username). If password is correct the menu shows the list of Function Block available, according to password level and username.
- By UP and DOWN select the Function Block “Actuator Setup” and then press ENTER.
- By UP and DOWN select the Function TAB “Positioner” and then press ENTER.
- By UP and DOWN select the parameter “DEAD BAND” and then press ENTER.
- The display shows the value of the Dead Band. Select “Help” to have additional information about the parameter. Press ENTER to exit from “Help”.
- By UP and DOWN move the cursor of display to the line “..”. Press ENTER to return to the previous level of menu.
- By UP and DOWN select “..” and then press ENTER, to return to previous level of menu. Alternatively press simultaneously UP and DOWN.
- Repeat the above step until the HOME VIEW appears.

20.4 Execution of an ECU cmd

The example shows the procedure to execute the command “Select opening signature”. Check the ECU cmd table. The command “**Select opening signature**” is in the Function Block “Log and Graph” and in the Function TAB “Curves”. The minimum password level requested is 1, associated to username “USER”.

- Press ENTER
- By UP and DOWN select the username and then press ENTER. The option available are “User”, “Operator” “Service”, “Specialist”, “Guest 0/1/2”
- By UP and DOWN select “ECU cmd” and then press ENTER.
- Enter the password. By UP and DOWN select the first character of password, then press ENTER to confirm.
- Repeat the above procedure and enter further 5 characters one at a time. Use number or capital letter.
- If password is not according to username the access to menu is not allowed. The display shows the previous option (selection of username). If password is correct the menu shows the list of Function Block available, according to password level and username.
- By UP and DOWN select the Function Block “Log and Graph” and then press ENTER.
- By UP and DOWN select the Function TAB “Curves”, then press ENTER.
- By UP and DOWN select the command “Select opening signature”, then press ENTER.
- The display shows the present value. Select “Help” to have additional information about the parameter. Press ENTER to exit from “Help”.
- By UP and DOWN select the number of the new opening signature curve and then press ENTER to set the new value.
- The cursor of display is on the line “..”. Press ENTER to return to the previous level of menu.
- By UP and DOWN move the cursor of display to the line “..”. Press ENTER to return to the previous level of menu.
- By UP and DOWN select “..” and then press ENTER, to return to previous level of menu. Alternatively press simultaneously UP and DOWN.
- Repeat the above step until the HOME VIEW appears.

20.5 Visualization of “Status and variables”



With reference to the “status and variables table” in par 19.7

- Press DOWN
- By UP and DOWN select the type of data to view
- Press ENTER.
- By UP and DOWN select the data to view
- Press ENTER to view the value
- Press ENTER to return to previous level menu
- By UP and DOWN move the cursor of display to the line “..”. Press ENTER to return to the previous level of menu.
- By UP and DOWN move the cursor of display to the line “..”. Press ENTER to return to HOME VIEW

Alternatively the switch to previous level of menu can be done by pressing simultaneously UP and DOWN

The following examples show the procedure to view “HPU oil pressure”, “Failure”, “Alarm”, and “Function summary”

20.5.1 Visualization of “HPU oil pressure”

The procedure allows viewing the value of the variable “HPU oil pressure”. The variable is measured only if the actuator is provided with HPU.

- Press DOWN
- By UP and DOWN select “ACTUATOR VARIABLES”
- Press ENTER
- By UP and DOWN move the cursor to select “OIL PRESSURE bar”.
- Press ENTER to view the value
- Press ENTER to return to the previous level of menu.
- By UP and DOWN move the cursor of display to the line “..”. Press ENTER to return to the previous level of menu.
- By UP and DOWN move the cursor of display to the line “..”. Press ENTER to return to HOME VIEW

20.5.2 Visualization of “Failure” and “Alarm”

The procedure allows viewing the list of Failures and Alarms

- Press ENTER
- By UP and DOWN select “FAILURE”
- Press ENTER to view the list of failures. Use UP and DOWN to scroll the list of failures
- By UP and DOWN move the cursor of display to the line “..”. Press ENTER to return to the previous level of menu.
- By DOWN select “Alarm”
- Press ENTER to view the list of alarms. Use UP and DOWN to scroll the list of alarms
- By UP and DOWN move the cursor of display to the line “..”. Press ENTER to return to the previous level of menu.
- By UP and DOWN move the cursor of display to the line “..”. Press ENTER to return to the HOME VIEW.

20.5.3 Visualization of “Function summary”

The procedure allows viewing the list of function enabled to work in the ECU1000 and their main parameters

- Press ENTER
- By UP and DOWN select “Function summary”
- Press ENTER to view the list of function. Use UP and DOWN to scroll the list.
- Press Enter to view if the function is enabled.
- Press Enter to return to the list of functions
- By UP and DOWN move the cursor of display to the line “..”. Press ENTER to return to the previous level of menu.

Example of function summary:

Positioner	MO-2PSOV	positioner in modulating mode, 2PSOV
Interlock	enable	Interlock enabled
Opt-SOV1	enable	Stayput SOV control enabled
PST	manual	PST available in Manual
PWM	enable	PWM module enabled
Open limit mode	position	Open limit by position
Close limit mode	continuous	Close limit continuous
ESD	go to position%	ESD set in “go to position”

Only the function present in the list work.

20.5.4 Command “Clear Failure and Alarm”

The procedure allows clearing the Failures and Alarms present in the ECU1000. If a Failure or Alarm is still detected by the ECU1000 it will appear again.

- Press ENTER
- By UP and DOWN select “Clear Fail-Alarm”
- Press ENTER. Use DOWN to select “Clear Fail-Alarm”.
- Press Enter. By UP and DOWN set the value “1”.
- Press Enter. The cursor of display return on “..”
- Press ENTER to return to the previous level of menu.
- By UP and DOWN move the cursor of display on the line “..”
- Press Enter to return to HOME VIEW



BIFFI ITALIA srl

Loc. Caselle S. Pietro n. 420, 29017 Fiorenzuola d'Arda (PC) ITALY

Tel. (0523) 94.44.11 - Fax (0523) 94.18.85 - e_mail: biffi_italia@biffi.it