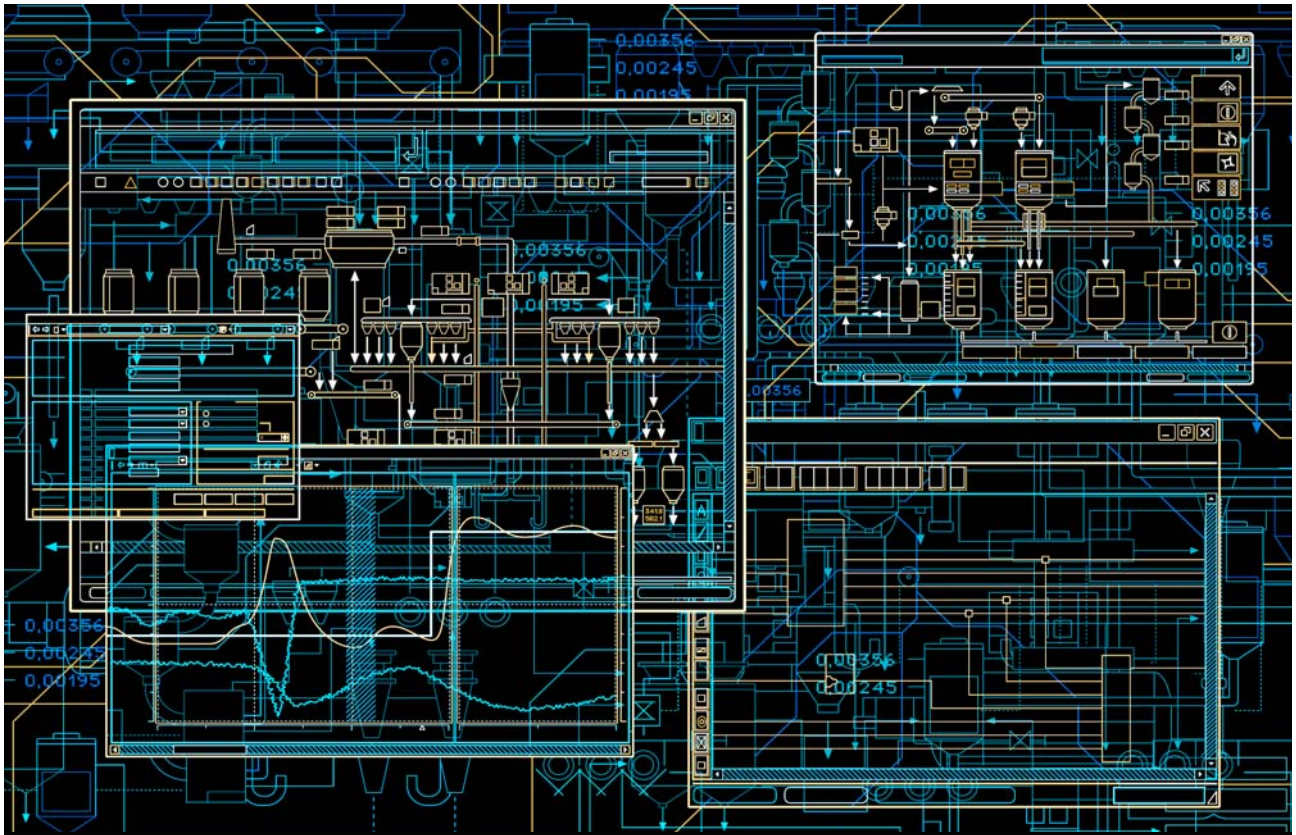

System 800xA

800xA for Freelance VB Graphics Extension Operation

System Version 6.0

Power and productivity
for a better world™

System 800xA

800xA for Freelance VB Graphics Extension Operation

System Version 6.0

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Section 9 - Sequence Control Function Blocks

About This User Manual

General

The present documentation describes the operation and display of the functions, function blocks and variables specific to 800xA for Freelance VB Graphic Extension. Further information on the function of the blocks may be found in the Freelance system documentation.

For latest information see also the corresponding Release Notes.

Use of Warning, Caution, Information, and Tip Icons

This publication includes **Warning**, **Caution**, and **Information** where appropriate to point out safety related or other important information. It also includes **Tip** to point out useful hints to the reader. The corresponding symbols should be interpreted as follows:

Electrical warning icon indicates the presence of a hazard which could result in *electrical shock.*

Warning icon indicates the presence of a hazard which could result in *personal injury.*

Caution icon indicates important information or warning related to the concept disussed in the text. It might indicate the presence of a hazard which could result in *corruption of software or damage to equipment/property.*

Information icon alerts the reader to pertinent facts and conditions.

Tip icon indicates advice on, for example, how to design your project or how to use a certain function

Although **Warning** hazards are related to personal injury, and **Caution** hazards are associated with equipment or property damage, it should be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process performance leading to personal injury or death. Therefore, comply fully with all **Warning** and **Caution** notices.

Document Conventions

The following conventions are used for the presentation of material:

- The words in names of screen elements (for example, the title in the title bar of a window, the label for a field of a dialog box) are displayed in *italics*.
- Capital letters are used for the name of a keyboard key if it is labeled on the keyboard. For example, press the ENTER key.
- Lowercase letters are used for the name of a keyboard key that is not labeled on the keyboard. For example, the **space bar**, **comma key**, and so on.
- Press CTRL+C indicates that you must hold down the CTRL key while pressing the C key (to copy a selected object in this case).
- Press **ESC E C** indicates that you press and release each key in sequence (to copy a selected object in this case).
- The names of push and toggle buttons are boldfaced. For example, click **OK**.
- The names of menus and menu items are boldfaced. For example, the **File** menu.
  - The following convention is used for menu operations: MenuName > MenuItem > CascadedMenuItem. For example: select **File > New > Type**.
  - The **Start** menu name always refers to the **Start** menu on the Windows Task Bar.
- System prompts/messages are shown in the Courier font, and user responses/input are in the boldfaced Courier font. For example, if you enter a value out of range, the following message is displayed:

```
Entered value is not valid. The value must be 0 to30.
```

You may be told to enter the string TIC132 in a field. The string is shown as follows in the procedure:

TIC132

Variables are shown using lowercase letters.

sequence name

Terminology

A complete and comprehensive list of Terms is included in *System 800xA System Planning (3BSE041389*)*. The listing includes terms and definitions that apply to the 800xA System where the usage is different from commonly accepted industry standard definitions and definitions given in standard dictionaries such as Webster's Dictionary of Computer Terms. Terms that uniquely apply to this instruction are listed in the following table..

Term/Acronym	Description
AE	OPC Alarms and Events
CBF	Freelance engineering tool Control Builder F
DA	OPC Data Access
OPC	OLE for Process Control
PLC file	Standard file format for Progammable Logic Control
SFC	Freelance Sequential Function Chart

Related Documentation

A complete list of all documents applicable to the 800xA System is provided in *System 800xA Released User Documents (3BUA000263*)*. This document lists applicable Release Notes and User Instructions. It is provided in PDF format and is included on the Release Notes/Documentation media provided with the system. *System 800xA Released User Documents (3BUA000263*)* is updated with each release and a new file is provided that contains all user documents applicable for that release with their applicable document number. Whenever a reference to a specific instruction is made, the instruction number is included in the reference.

Table 1.

Category	Title	Description
Connectivity	800xA for Freelance, Release Notes	2PAA112403*
	800xA for Freelance, Configuration	3BDD011812*
	800xA for Freelance, Installation	3BDD011810*
VB Graphics Extension	800xA for Freelance VB Graphics Extension, Installation	2PAA108085*

Section 1 Freelance Faceplates

General

The present documentation describes the operation and display of the functions, function blocks and variables specific to Freelance in 800xA Operations. Further information on the function of the blocks can be found in the Freelance documentation.

The operation and display of the function-specific variables in 800xA Operations are through faceplates.

Faceplate Structure

All faceplates are subdivided into the following areas:

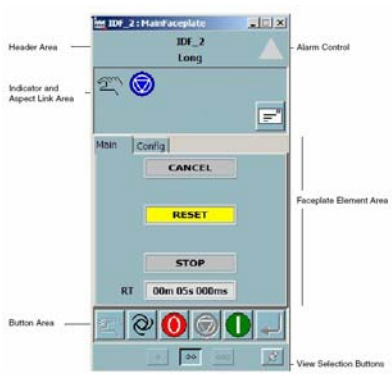

Figure 1. Main Faceplate

Header Area

Each faceplate contains a header area consisting of the following parts

- Object lock control (optional)
- Object name (mandatory)
- Object description (mandatory)
- Alarm control (optional)

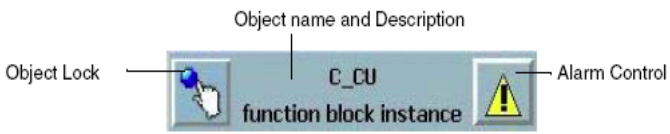

Figure 2. Function Block Instance

The **Object Lock** control is optional and only visible in the header area if lock handling is activated. The object lock icon indicates the lock state. All objects that need their lock to be handled by faceplates must have an aspect with the name LockControl.

The **Object Name** area displays the name of the object. Names that are too long are truncated and '...' is appended at the end if the width of the faceplate area is not sufficient to display the full name. A tooltip will always show the complete name of the button/text it is positioned above.

The **Object Description** area displays the description of the object, and the tooltips work the same way as in the name area.

The **Alarm Control** button is optional. It indicates the alarm state of the object and enables the operator to acknowledge the alarms. Alarm control is an aspect of type graphic element. The faceplate framework just reserves space for it in the header area and shows it if the object reports an alarm.

Indicator and Aspect Link Area

In this area of the faceplate the Indicators and Aspect Links can be allocated.

Indicators show a label, or an icon, as the result of a configured expression, which can include one or several object properties subscribed for. The standard icon format is 32x32 (normal Windows icon size).

Aspect links are buttons that act as shortcuts to bring up another aspect as an overlap window. The maximum number of indicators and aspect links allowed in the status and navigation bar is controlled by the layout settings in the configuration view of the faceplate. A faceplate view with default configuration settings has space for a total of 6 indicators and aspect links. The amount of rows to be displayed in the status and navigation bar area can also be configured.

Faceplate Element Area

Aspects are displayed in the faceplate element area, either alone or included in tab groups. Primarily, faceplate element aspects are intended to be included in this area. Other aspects may also be included. The orientation of those aspects and/or tab groups can be either horizontal (the default order) or vertical, but not both in the same faceplate aspect.

The faceplate element area in the following figure contains 2 tab groups arranged horizontally. In order to see the **Limits** tab, you have to click to select it, since **Default** is currently the active tab in the left tab group.

Figure 3. Faceplate Element Area

View Selection Buttons

Select the faceplate view. If a view does not exist, the button representing that view is faded.

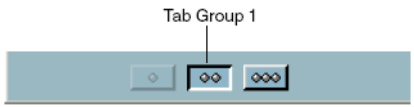

Figure 4. Selection Buttons

Symbols and Buttons

Operator Area of the Faceplates

The buttons in the operator area of the faceplates are used for operation and signalling. Signalling is realized using different button colors:

Status	Signalling
Not active	Background color grey
Active	Background color yellow
Activated (must be confirmed)	Background color green
Operable	Symbol color black
Not operable	Symbol color grey

After a button is activated, it normally has to be confirmed by pressing the Return button (except for continuous controller adjustment with the buttons SpUp, SpDown, OutUp, OutDown).

Buttons in the operator area of the faceplates:

Button	Designation	Description
	Aut	Automatic
	Man	Manual
	Ext	External Value
	Int	Internal Value
	On	On/off Command
	Off	Off/on Command
	Stop	Stop Command
	Reset	Reset
	Coarse	Coarsing dosing command
	Fine dosing	Fine dosing command
	ValveClose	Dosing off
	SpUp	Setpoint Up

	SpDown	Setpoint Down
	OutUp	Output Up
	OutDown	Output Down
	Ratio	Ratio controller switchover (controller)
	SP	Fixed set point controller switchover (controller)
	CarryOut	Continue inching (SFC)
	Km1	Select inching mode 1 (SFC)
	Km2	Select inching mode 2 (SFC)
	Km3	Select inching mode 3 (SFC)
	Km4	Select inching mode 4 (SFC)
	Skip	Skip (scheduler)
	Scroll	Scroll (scheduler)
	NumCyc	Operation of a certain number of cycles (scheduler)

	Perm	Permanent operation/continuous operation (scheduler)
	Tune1	Step response stationary
	Tune2	User defined parameter set
	Tune3	Self tune PID parameter set
	Tune4	Self tune off
	Tune5	Self tune on
	Tune6	Controller dynamics low
	Tune7	Controller dynamics medium
	Tune8	Controller dynamics high
	Tune9	Parameter scheduler off
	Tune10	Parameter scheduler on
	Dec1	Decrement 1
	Dec3	Decrement 3

	Dec10	Decrement 10
	Inc1	Increment 1
	Inc3	Increment 3
	Inc10	Increment 10
	Return	Confirmation/Apply

Display Area of the Faceplates

In the display area of the faceplates, symbols or identifiers (for example SP for set point) are displayed to the left of the numerical display. If the values are operable, the symbols or identifiers appear in the form of buttons. When selecting a button, an input mask appears in which the value can be changed.

Alarm Area of the Faceplates

Symbols in the alarm area of the faceplates:

Button	Designation	Description
	Operator Log	Operator Log

Section 2 Analog Function Blocks

Analog Input Transformation, AI_TR

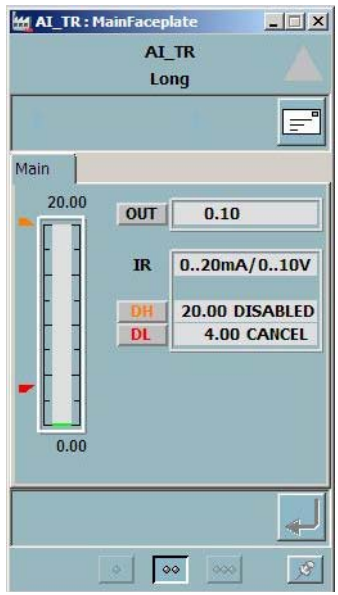

Figure 5. Analog Input Transformation

Display

Name, short text, scale range.

The converted analog value *Out* as a bar and as a numerical value as well as the default values DL and DH as numerical values and as horizontal markers to the left of the bar. If a default value is used (undershoot or overshoot) the analog value *Out* will be output in red.

Outputting the input range *IR* 0...20 mA or 4...20 mA.

Operator Interventions

Message acknowledgement.

Analog Output Transformation (transient), AI_TRT

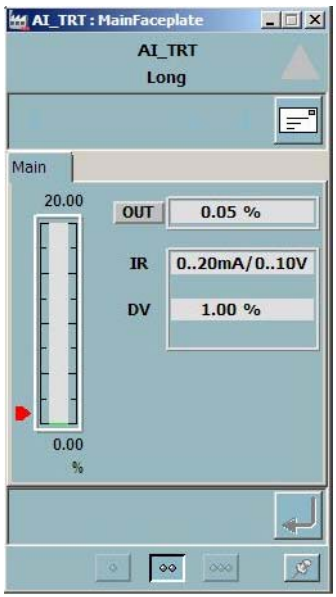

Figure 6. Analog Output Transformation

Display

Name, short text, scale range and physical unit.

The converted analog value *Out* as a bar and a numerical value as well as the default value *DV* as numerical value and as horizontal markers to the left of the bar. If a default value is used (undershoot or overshoot) the analog value *Out* will be output in red.

Outputting the input range *IR* 0...20 mA or 4...20 mA.

Operator Interventions

Message acknowledgement.

Analog Output Transformation, AO_TR

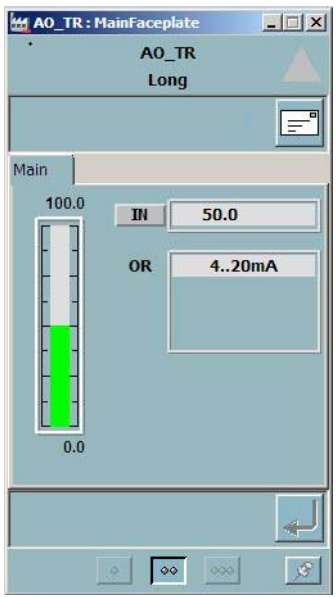

Figure 7. Analog Output Transformation

Display

Name, short text, scale range.

The analog value *In* as bar and numerical value. Signal range output *OR* 0...20 mA or 4...20 mA.

Operator Interventions

None

Counter with Analog Input, CT_ANA

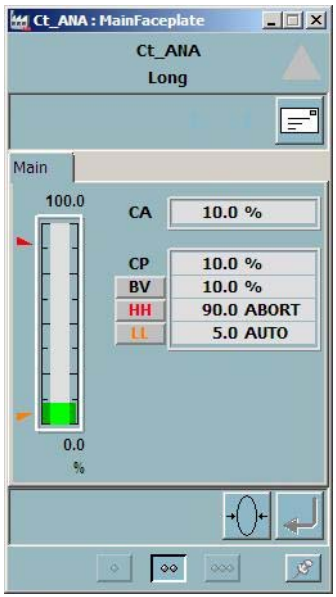

Figure 8. Counter with Analog Input, CT_ANA

Display

Name, short text, scale range and physical unit.

Current counter reading *CA*, counter reading of last period *CP* and the basic value BV as numerical values. Also the current counter reading *CA* as actual value bar chart and the last period counter reading *CP* as set point bar charts.

Limit values L1 and L2 as numerical values and corresponding marker on the counter reading bar.

Operator interventions

Reset the counter with the Reset button.

Change the basic value BV and limit values L1, L2. The buttons for the limit values are equipped with corresponding symbols depending on the configured limit value types.

Message acknowledgement.

Set Point Controller, C_ANA

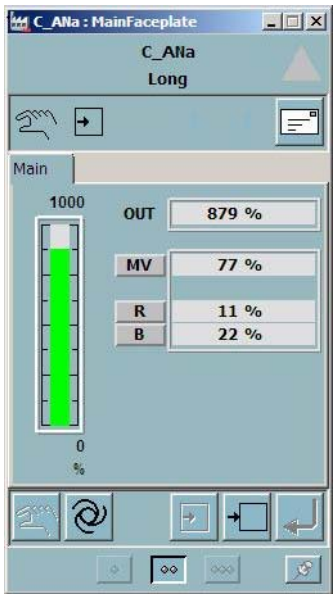

Figure 9. Set Point controller, C_ANA

Display

Name, short text, scale range and physical unit.

Output value *Out*, manual value MV, ratio R and bias B as numerical values. Output value *Out* as an actual value bar chart.

Operator Interventions

Switching of the operation mode MAN/AUTO with the Man and Aut buttons.

switching of internal/external operating mode with the buttons SpInt and SpExt.

Changing the manual value MV (possible only in manual operating mode) and changing the internal values of ratio and bias.

Time Scheduler, TS

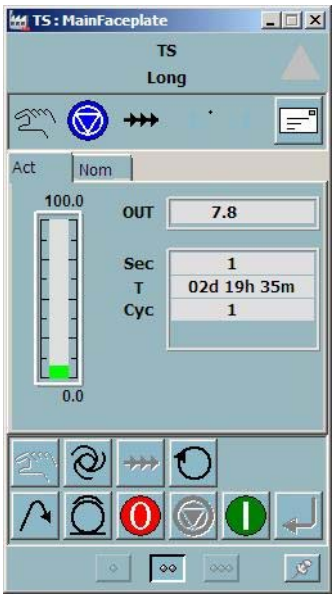

Figure 10. Time Scheduler

Display

Name, short text, scale range.

In the faceplate of the time scheduler the current output value *Out* is shown as a value bar chart and as numerical values. By selecting Act/Nom it is possible to switch the content of the display between actual and nominal values.

Display	Act selected	Nom selected
Sec	Number of the actual section	Number of configured section
T	Running time since the start of a time plan	Time marker of the nominal curve
Cyc	umber of the actual run	Number of configured run cycles
Off	-/-	Offset time scheduler

The actual running status can be seen by means of corresponding signals (colour highlighted button) on the control panel.

Operator interventions

Switching over the operating mode with the Man/Aut buttons.

Switching over the running mode between permanent (Perm button) and - according to the set number of cycles - the NumCyc button. Setting of the running status OFF, STOP, ON, SKIP, SCROLL with the buttons Off, Stop, On, Skip, Scroll.

If Nom is selected the time scheduler offset Off and the number of run cycles Cyc can be changed.

Section 3 Binary Function Blocks

Time Counter, CTT

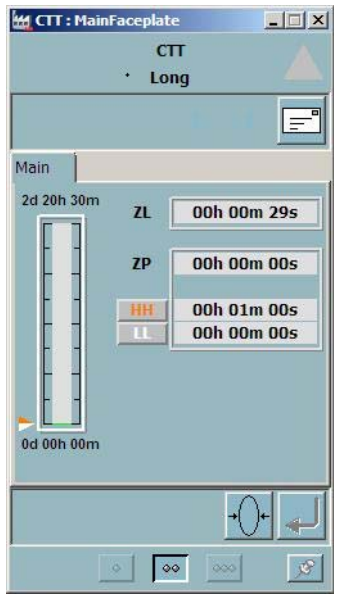

Figure 11. Time Counter, CTT

Display

Name, short text, the current counter reading *ZL* and the counter reading of the last period *ZP* as bar and numerical values. Up to two limit values L1, L2 as numerical values and markers on the bar.

Operator interventions

Changing the limit values L1, L2 and Resetting of the time value output to 0.

Message acknowledgement.

Up/Down Counter, CTUD

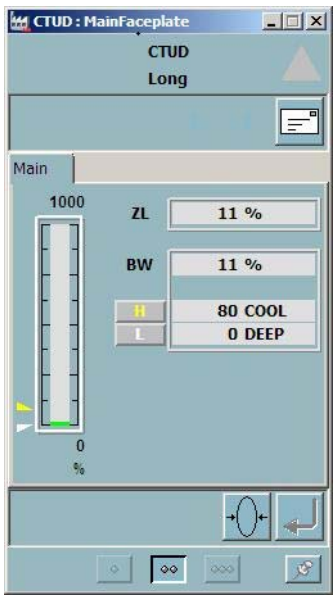

Figure 12. Up/Down Counter, CTUD

Display

Name, short text. The analog output signal of the current counter reading *ZL* as numerical value. Also as numerical values the basic value *BW* and the limit values L1, L2. Also the limit values as markers next to the bar.

Operator interventions

Changing the limit values L1, L2 and resetting the counter with the Reset button.

Message acknowledgement.

Operating Time Counter, CT_LT

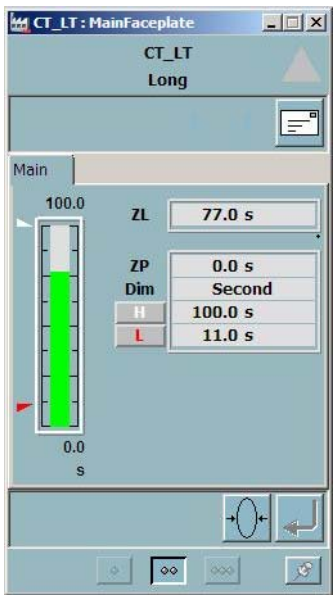

Figure 13. Operating Time Counter, CT_LT

Display

Name, short text, the current counter reading *ZL* and the counter value of the last period *ZP* as bar and numerical values. Up to two limit values L1, L2 as numerical values and as markers on the bars.

Operator interventions

Changing the limit values L1, L2 and resetting the counter to 0 with the Reset button.

Message acknowledgement.

Pulse Counter, CT_P

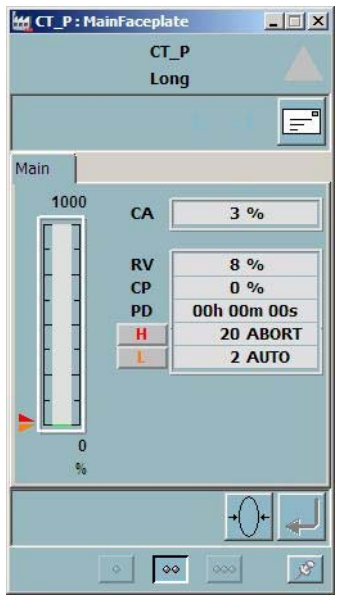

Figure 14. Pulse Counter, CT_P

Display

Name, short text. The analog output signal of the last period *CP* and the current counter reading *CA* as numerical values and bar graphs. Additionally, the period length *PD*, the overflow value *RV* and the limit values as numerical values. The limit values L1, L2 are also displayed as markers next to the bar graphs.

Operator Interventions

Changing the limit values L1, L2 and resetting the counter using the Reset button.

Message acknowledgement.

Frequency/Analog Converter, FAC_D

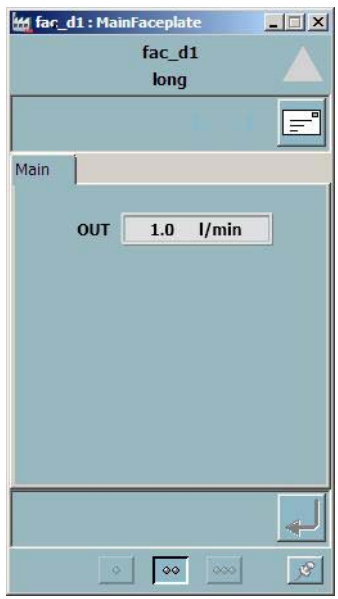

Figure 15. Frequency/Analog Converter, FAC_D

Display

Name, short text, analog output signal *OUT* as numerical value and physical unit.

Operator Interventions

None

Monoflop, MONO_F

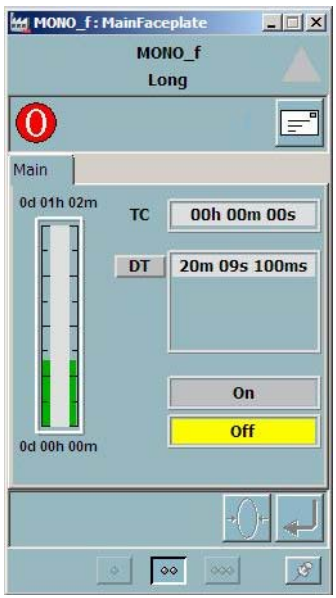

Figure 16. Monoflop, MONO_F

Display

Name, short text, the pulse duration DT, and the elapsed time *TC* as bar and numerical values.

The state of the output, "*ON*" (logical 1 signal), "*OFF*" (logical 0 signal).

Operator interventions

Changing the pulse duration PD within the valid scale range and premature abort with the Reset button (Output is set to logical 0 signal).

Message acknowledgement.

Binary Output, M_BOUT

Figure 17. Binary output, M_BOUT

Display

Name, short text, operating mode with Man and Aut buttons and configured state texts. The text for the current state is highlighted yellow.

Operator interventions

Switching over operating mode with the Man and Aut buttons. In manual mode the output can be switched over by the operator using On/Off buttons.

Timer

Switch-on/off Delay, TONOF / Switch-off Delay, TOF / Switch-on Delay, TON

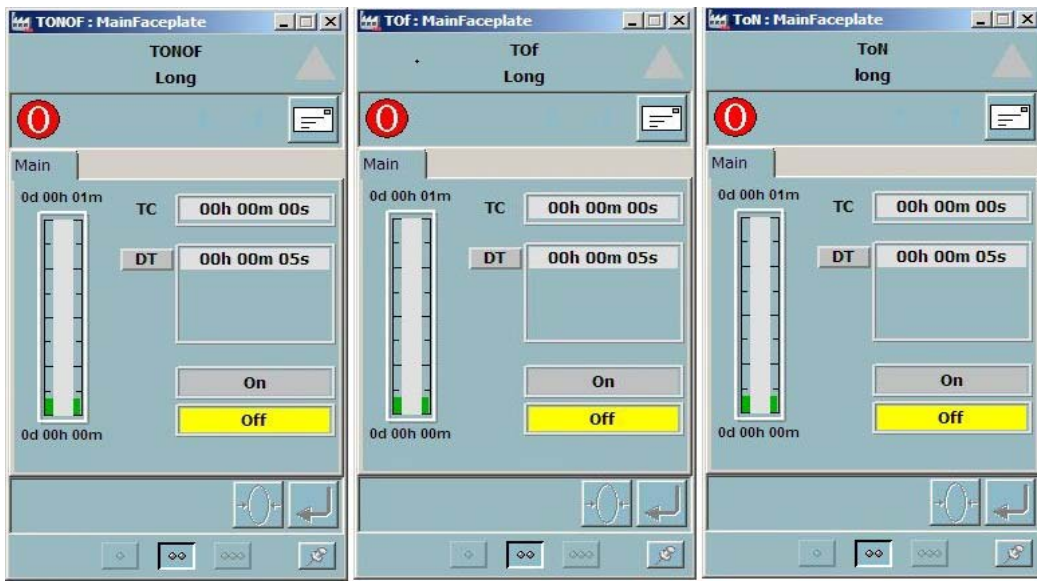

Figure 18. Timer

Display

Name, short text, the delay time DT and the elapsed time *TC* as bar graph and numerical values. The state of the output, "*ON*" (logical 1 signal), "*OFF*" (logical 0 signal).

Operator Interventions

Changing the switch-on time DT within the valid scale range and premature abort using the Reset button (output is set to logical 0 signal).

Message acknowledgement.

External Input, TIMER

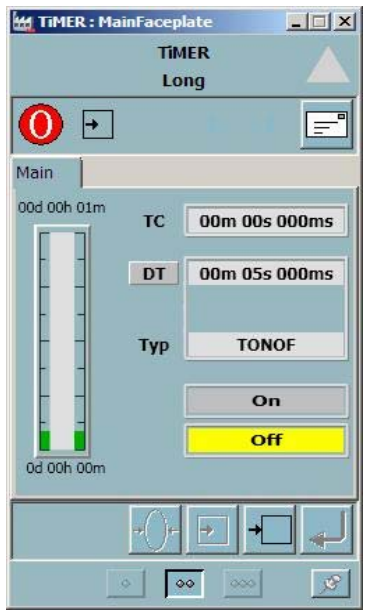

Figure 19. External Input, Timer

Display

Name, short text, switch-on or delay time DT and the elapsed time *TC* as bar and numerical values and the timer type.

Display of the timer behaviour *Typ*.

Operator Interventions

Changing the switch-on and delay time with the DT button, premature abort with the Reset button and switching over the setpoint operating mode (internal/external) via the SpInt/ SpExt buttons.

Message acknowledgement.

Touch Button, TOUCH

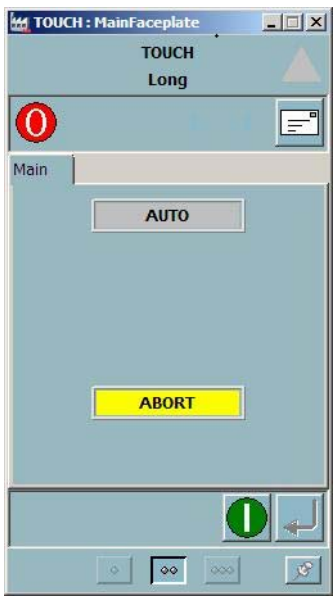

Figure 20. Touch Button, TOUCH

Display

Name, short text, status texts for on/off.

Operator Interventions

The touch button can be activated by using the On button.

Section 4 Monitoring Function Blocks

Event Message, EVENT

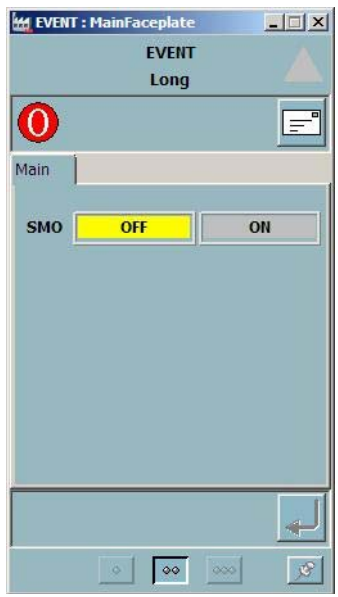

Figure 21. Event

Analog, M_ANA

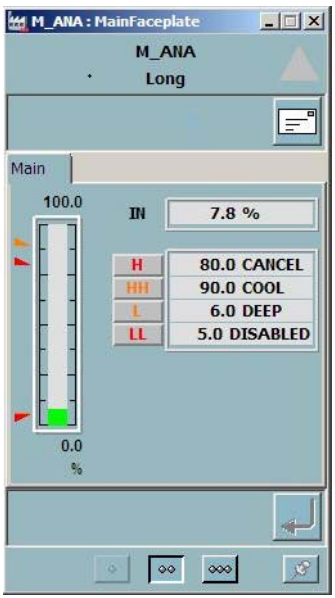

Figure 22. Analog, M_ANA

Display name

Name, short text, input signal *In* as bargraph and numerical value.

Message display for changing speed limit values.

Limit values L1..L4 as markers and numerical values.

Operator interventions

Changing limit values with the buttons L1...L4. The buttons are dependant on the configured limit value types provided with respective symbols.

Message acknowledgement.

Antivalence, M_BAV

Figure 23. Antivalence, M_BAV

Display

Name, short text and message status text, the current state with yellow background.

Operator interventions

Message acknowledgement.

Binary, M_BIN

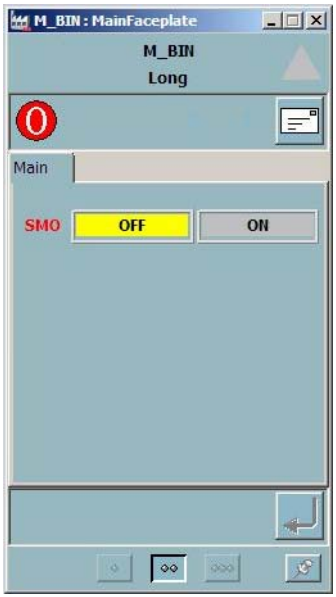

Figure 24. Binary, M_BIN

Display

Name, short text and message status text, the current state with yellow background.

Operator interventions

Message acknowledgement.

Universal, M_GEN

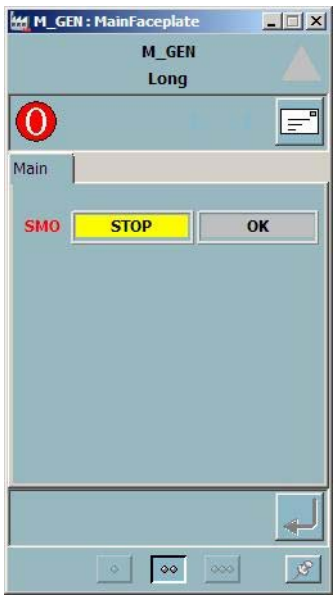

Figure 25. Universal, M_GEN

Display

Name, short text and message status text, the current state with yellow background.

Operator interventions

Message acknowledgement.

Section 5 Controller Function Blocks

Continuous Controllers

Universal, C_CU / Standard, C_CS / Ratio, C_CR

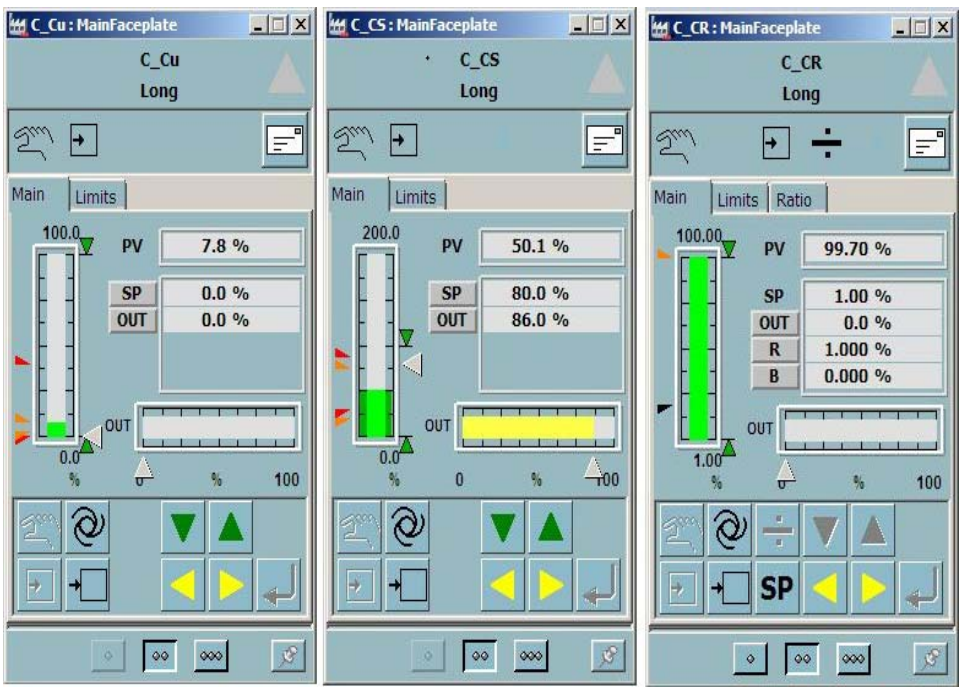

Figure 26. Universal, C_CU / Standard, C_CS / Ratio, C_CR

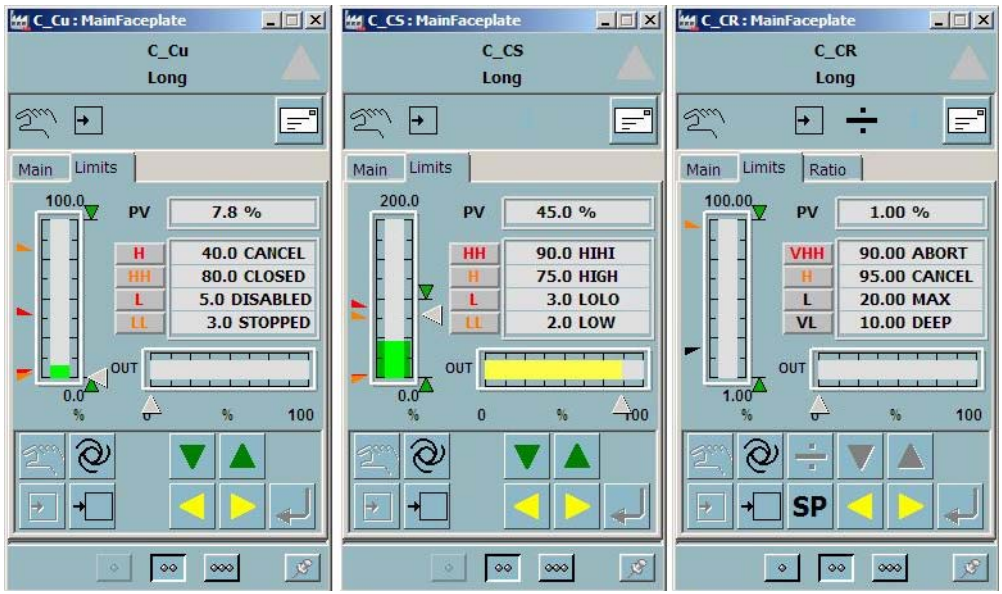

Figure 27. Universal, C_CU / Standard, C_CS / Ratio, C_CR

Display

Name, short text, scale range and physical unit.

Set point SP, process value *PV,* output variable OUT and ratio *RV* (C_CR) as numerical values and as bar graphs. The set point bar graph encloses the process value bar graph with the output variable to the right.

C-CR: Ratio R and bias B as numerical values.

Limit values L1 to L4 as numerical values (*Lmts* selected) and corresponding markers on the process value bar graph.

Tracking in signalling field with the *TRACK* symbol (not with C_CS).

C_CR: The controller display in the faceplate can take place as media display (Abs selected) or as ratio display (Ratio selected). The table shows the bar chart in the faceplate.

	Display	Process value bar chart	Set point bar chart
Fixed value controller	Media	PV	$W_{internal}$
	Ratio	RV = (PV-B) / (W_{ext} * L)	R
Ratio controller	Media	PV	W_{ext} * R * L + B
	Ratio	RV = (PV-B) / (W_{ext} * L)	R

Operator Interventions

The set point SP can be changed in automatic and manual modes.

The output variable OUT can only be changed in manual mode.

The set point can be switched to internal or external operating mode with the SpInt/SpExt buttons. The output variable can be set to manual or automatic mode using the Man/Aut buttons.

C_CR: Switching over between ratio controller (Ratio button) and the fixed value controller (Sp button). Ratio R and bias B can also be changed

The up to four limit values L1 ...L4 may be changed if parameterized.

Message acknowledgement.

Display

Name, short text, scale range and physical unit.

Set point SP, process value *PV* and position feedback signal FB as numerical values and bar graphs. The set point bar graph encloses the process value, with the position response to the right.

With feedback switched on, the position feedback signal FB appears as a bar graph and as a numerical value. If the feedback is not switched on or interrupted, i.e. if the FBF signal is logical 1, an empty field appears instead of the numerical value.

The current direction of motion of the output variable is displayed using arrows next to the position feedback signal bar graph.

Arrow right means: Output OP active

Arrow left means: Output ON active

Limit values L1...L4 as numerical values (*Lmts* selected) and the corresponding marker on the process value bar graph.

Operator Interventions

The internal set point SP can be altered in automatic and manual modes. The output variable FB can only be set in manual mode. If an external feedback has been configured and is switched on, the output variable can be adjusted as an absolute percentage. Without an effective external feedback, only an incremental input of the output variable can be achieved using the OutUp or OutDown buttons.

The set point can be switched to internal or external operating mode with the SpInt/SpExt buttons. The output variable can be set to manual or automatic mode using the Man/Aut buttons.

The up to four limit values L1...L4 can also be altered.

Message acknowledgement.

Step Controllers

Universal, C_SU / Standard, C_SS / Ratio, C_SR

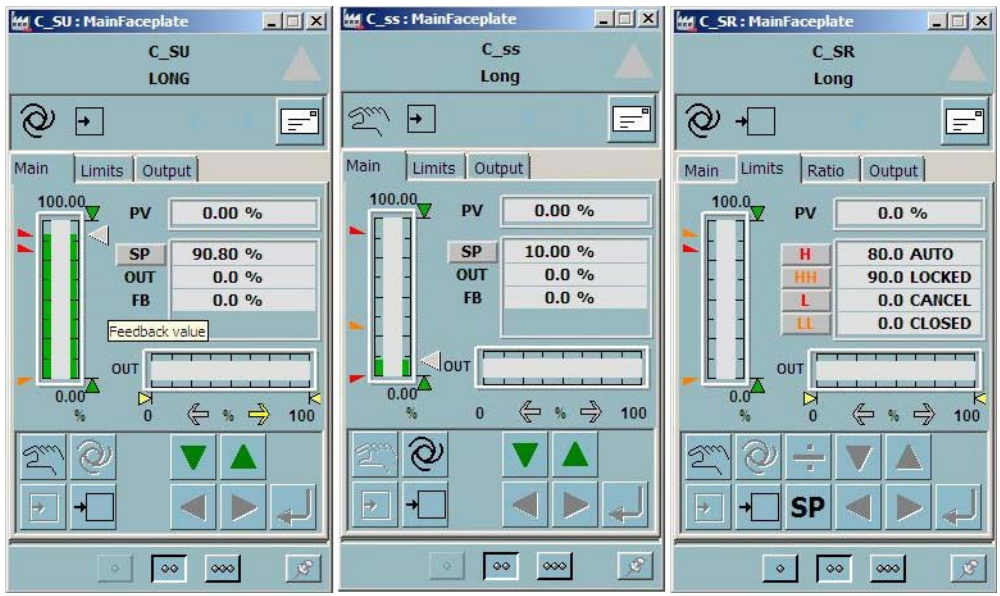

Figure 28. Step Controllers

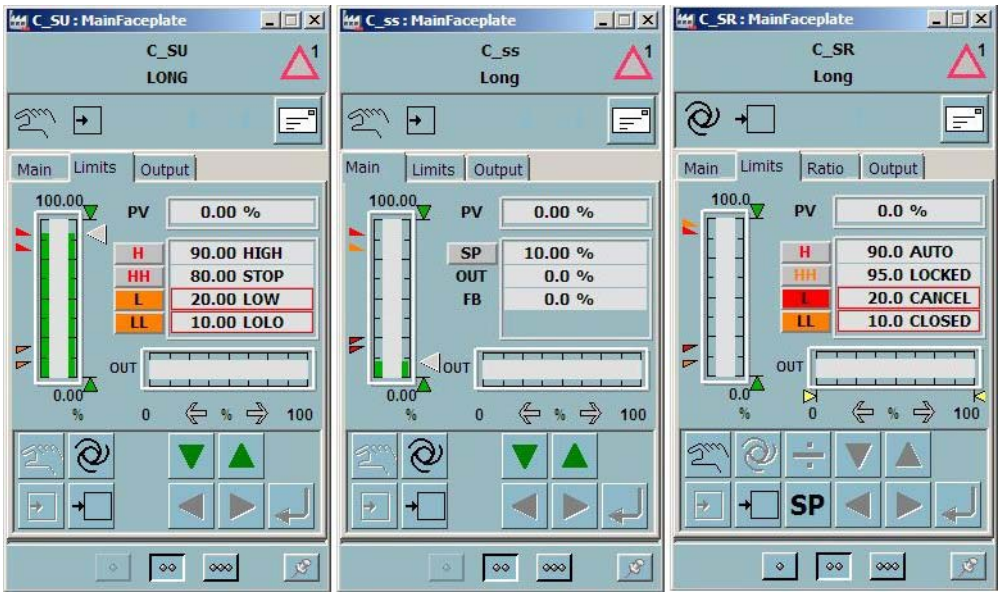

Figure 29. Step Controllers

Display

Name, short text, scale range and physical unit.

Set point SP, process value *PV,* position feedback FB and ratio RV (C_SR) as numerical values and as bar graphs. The set point bar encloses the process value. On the right-hand side, the bar graph for the position feedback signal is shown.

C-SR: Ratio R and bias B as numerical values.

With feedback switched on, the position feedback signal *FB* appears as a bar graph and as a numerical value. If the feedback is not switched on or interrupted, i.e. if the FBF signal is logical 1, an empty field appears instead of the numerical value.

The current direction of motion of the output variable is displayed using arrows next to the position feedback signal bar graph.

Arrow right means: Output block OP active

Arrow left means: Output block ON active

Limit values L1...L4 as numerical values (*Lmts* selected) and the corresponding marker on the process value bar graph.

Tracking in signalling field with the *TRACK* symbol (not with C_SS).

C_SR: The controller display in the faceplate can take place as media display (Abs selected) or as ratio display (Ratio selected). The table shows the bar chart in the faceplate.

	Display	**Process value bar chart**	**Set point bar chart**
Fixed value controller	Media	PV	$W_{internal}$
	Ratio	RV = (PV-B) / (W_{ext} * L)	R
Ratio controller	Media	PV	W_{ext} * R * L + B
	Ratio	RV = (PV-B) / (W_{ext} * L)	R

Operator Interventions

The internal set point SP can be changed in automatic and manual modes. The output variable FB can only be set in manual mode. If an external feedback has been configured and is switched on, the output variable can be adjusted as an absolute percentage. Without an effective external feedback, only an incremental input of the output variable can be achieved.

The set point can be switched to internal or external operating mode with the SpInt/SpExt buttons. The output variable can be set to manual or automatic using the Man/Aut buttons.

C_SR: Switching over between ratio controller (Ratio button) and the fixed value controller (Sp button). Ratio R and bias B can also be changed

The up to four limit values L1...L4 may also be changed if parameterized.

Message acknowledgement.

Two Position Controllers

Universal, C_OU / Standard, C_OS

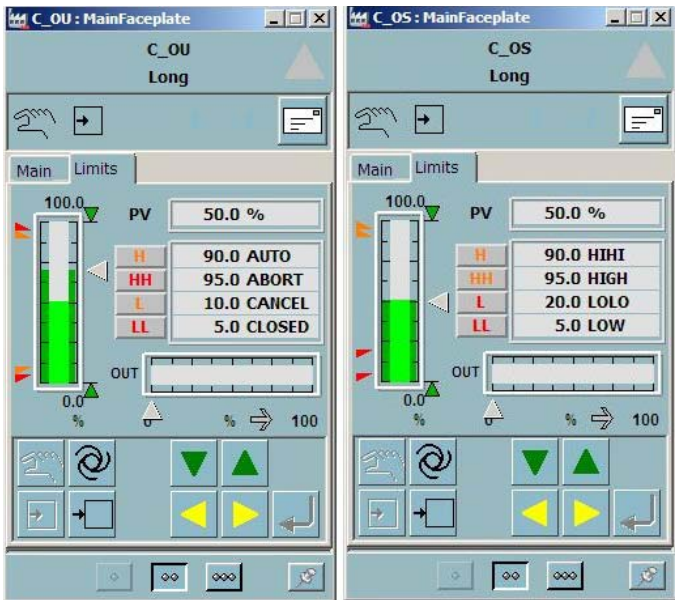

Figure 30. Two Position Controllers

Display

Name, short text, scale range and physical unit.

Set point SP, process value *PV* and internal output variable OUT as numerical values and bar chart. The set point bar encloses the process value bar, with the internal continuous output variable to the right of the bar.

The current status of the control of the output is shown with the *arrow on the right* under the position feedback signal bar.

Limit values L1...L4 as numerical values and corresponding markers on the process value bar.

C_OU: Tracking in signalling field with the *TRACK* symbol.

Operator interventions

The internal set point SP can be altered in automatic and manual modes with the SP button.

In the manual operating mode the continuous internal output variable Y can be altered and with it the binary output OB in accordance with the configured pulse width modulation.

The set point W can be switched to internal or external operating mode with the SpInt/SpExt buttons, he output variable operating mode to manual or automatic with the Man/Aut buttons.

The four maximum limit values L1...L4 can also be altered.

Message acknowledgement.

Three Position Controllers

Universal, C_PU / Standard, C_PS

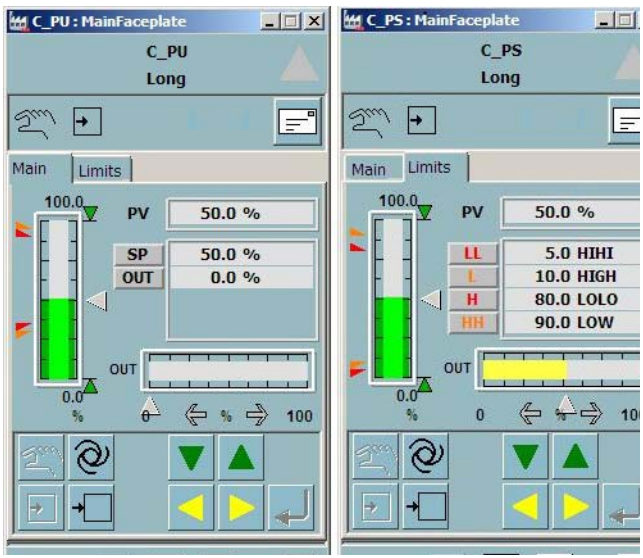

Figure 31. Three Position Controllers

Display

Name, short text, scale range and physical unit.

Set point SP, process value *PV* and internal output variable OUT as numerical values and bar chart. The set point bar encloses the process value bar, with the internal continuous output variable to the right of the bar.

The current status of the control of the binary outputs OB1, OB2 are shown by the *arrows on the right* under the position feedback signal bar.

Arrow right means: Output OB2 is active.

Arrow left means: *Output* OB1 is active.

Limit values L1...L4 as numerical values and corresponding markers on the process value bar.

C_PU: Tracking in signalling field with the *TRACK* symbol.

Operator interventions

The internal set point SP can be altered in automatic and manual modes with the SP button. In manual operating mode the continuous internal output variable OUT can be changed and with it the control of the binary outputs OB1 and OB2 according to the configured split range characteristic and pulse width modulation.

The set point W can be switched to internal or external operating mode with the SpInt/SpExt buttons, he output variable operating mode to manual or automatic with the Man/Aut buttons.

The four maximum limit values L1...L4 can also be altered.

Message acknowledgement.

Self-tune controller, TUNE

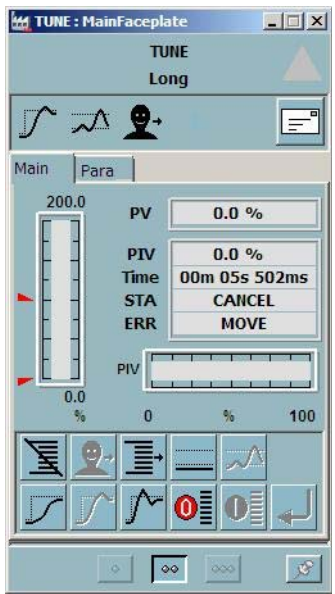

Figure 32. Self-tune controller, TUNE

Display

Name, short text, scale range and physical unit. Current process value *PV* and correction value *PIV* as numerical values and in bar chart form. Minimum and maximum process value as corresponding markers on the process value bar and on the right is the bar with the correction value.

The display can be switched over between the current values and the PID parameters.

Values selected: Correction value *PIV*, current test step duration *Time*, current status of selftune *Stat* and and error status *Err* as a text display.

PID selected: Proportional coefficient *CP*, reset value *TR*, rate time *TD* and the derivative action gain *CD*.

Operator interventions

Start (R button) and stop (S button) for the selftune parameter. Switching over the parameter control with the Off button (without coincidence points) and On (with coincidence points).

Exchange of the PID parameter set between selftune (TP button) and the user defined parameters (UP button).

Set controller dynamics with the Lo button (low) No button (normal) and Hi (high). Set stationarity with the ST button.

Message acknowledgement.

Section 6 Open Loop Control Function Blocks

Individual Drive Functions

Unidirectional Units, IDF_1 / Bi-directional Units, IDF_2 / Actuators, IDF_A

Figure 33. Individual Drive Functions

Display

Name, short text. Two state fields (IDF_1) or three state fields (IDF_2, IDF_A) with the configured command texts, which indicate the switch state of the individual drive modules. The text of the active switch state is displayed on a yellow background, the text of the non-active state on a dark-grey background. When the control command is disabled, texts are displayed in grey and the non-active switch state on a grey background.

An arrow shows the current direction of motion of the control element. The direction-of- motion arrow flashes when the control element is “moving”. In the

event of an end- position error or a run-time error, the end position to be attained is indicated by a static direction-of-motion arrow in the faceplate.

The monitoring time configured is indicated by *RT*.

A past safety intervention is indicated by black text on white background. This display will be reset in automatic mode or after an operation intervention.

Message texts can be allocated within the parameter mask depending on the following signals and statuses:

- during a fault signal,
- when run time is exceeded,
- on leaving the end position without control command,
- during safety intervention signals,
- during local intervention signal.
- during blocking (IDF_A)

Operator Interventions

Changing the operating mode between manual and automatic using the Man and Aut buttons.

IDF_1: In manual operating mode the control command can be changed with the On and Off buttons.

IDF_2, IDF_A: In manual operating mode the control command can be changed for two directions, and a stop command can be entered using buttons On, Off, Stop.

Message acknowledgement.

Dosing Circuits, DOS, DOS_A and DOS_E

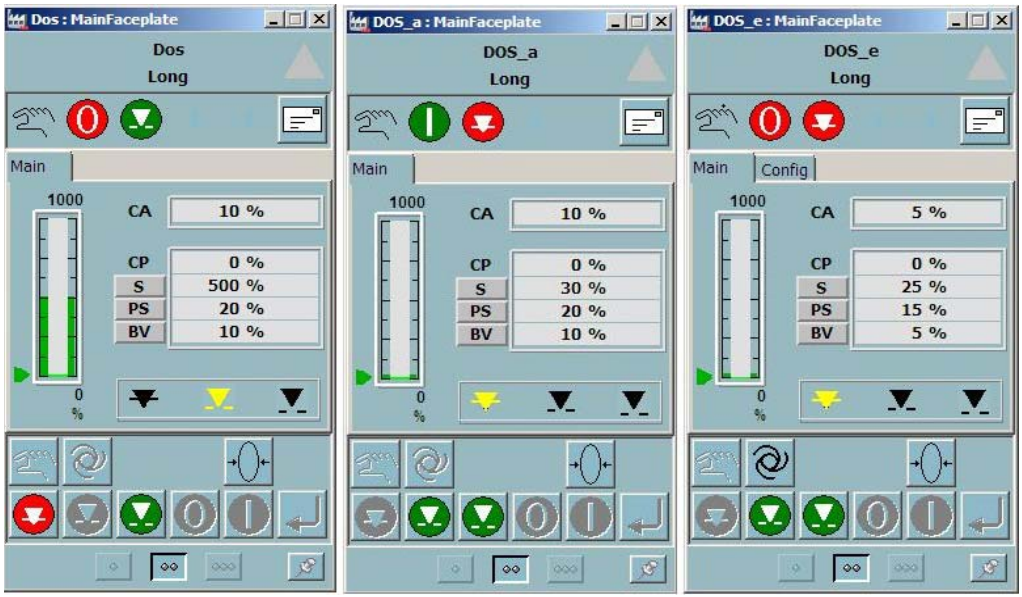

Figure 34. Dosing Circuits

Faceplates for DOS_A and DOS_E are similar

Display

Name, short text, scale range and physical unit.

Current counter reading *CA* and switch-off value S as numeric values and as a bar chart. As further numeric values the current counter reading of the last period *CP*, the pre-threshold value PS and the basic value BV. The basic value also as a mark immediately to the left of the bar graph.

The dosing mode coarse/fine dosing or valve CLOSED, symbols displayed beside the columns.

Operator interventions

Input of basic value BV, pre-threshold value PS and switch-off value S.

Changing the operating modes manual and automatic, buttons Man and Aut.

In automatic mode the dosing circuit can be stopped using the Stop button and can be reactivated using the Enable button. The current counter reading is set to basic value with the Reset key.

In manual, dosing can take place with the Coarse (coarse dosing), Fine (fine dosing), ValveClose (dosing off) button.

Section 7 Constant Function Blocks

Constant Inputs, CSTBO, ... , CSTWO

The following constant function blocks are available:

CSTBO	Input of False or True
CSTBY	Input of bytes
CSTDI	Input of double integer value with sign
CSTDT	Input of date and time
CSTDW	Input of double word value
CSTIN	Input of integer value
CSTRE	Input of floating point value
CSTTI	Input of time value
CSTUD	Input of double integer word value without sign
CSTUI	Input of integer word value without sign
CSTWO	Input of word value

Display

Name, short text and numeric value of the constant *CV*. With the function blocks CSTDI, CSTIN, CSTRE, CSTTI, CSTUD and CSTUI an additional scaling (*L* and *H*) is displayed.

Operator Interventions

Changing of the operating numeric value of the constant.

Input Boolean, CSTBO / Input Byte, CSTBY

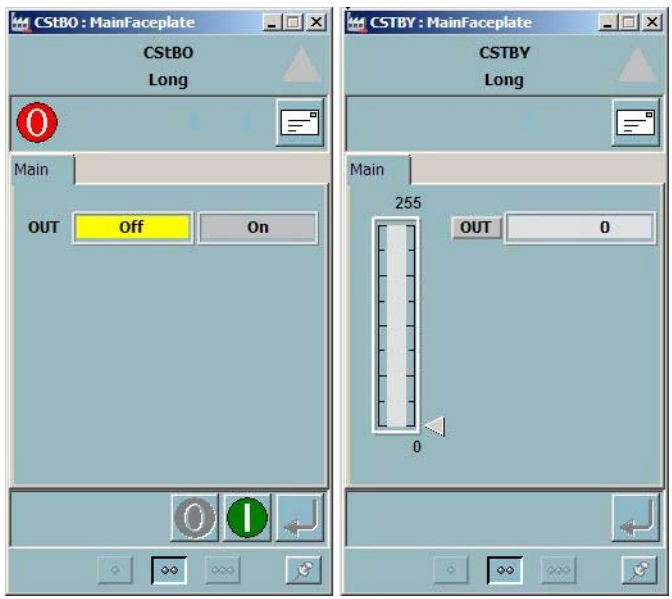

Figure 35. Input Boolean, CSTBO / Input Byte, CSTBY

Input Double Integer, CSTDI / Input Date and Time CSTDT

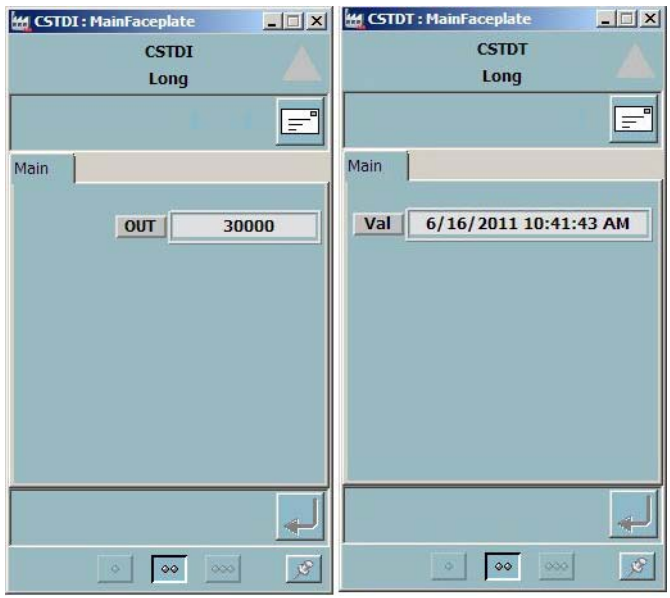

Figure 36. Input double integer, CSTDI / Input date and time CSTDT

Input Double Word, CSTDW / Input Integer, CSTIN

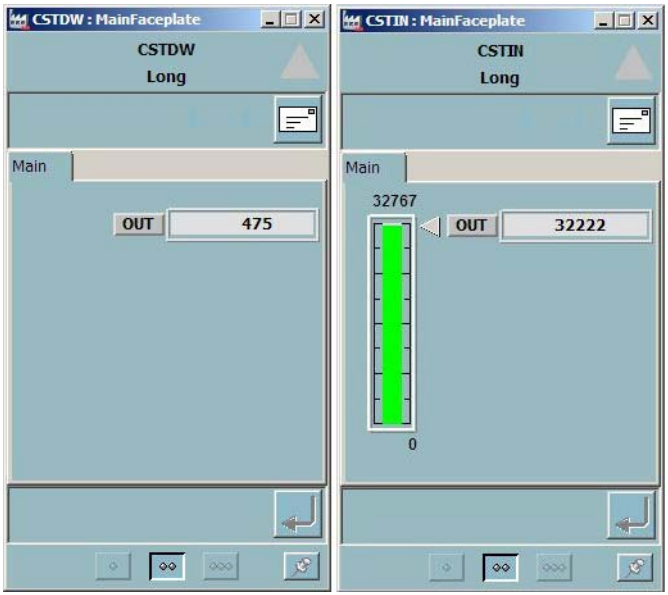

Figure 37. Input Double Word, CSTDW / Input Integer, CSTIN

Input floating point, CSTRE / Input time, CSTTI

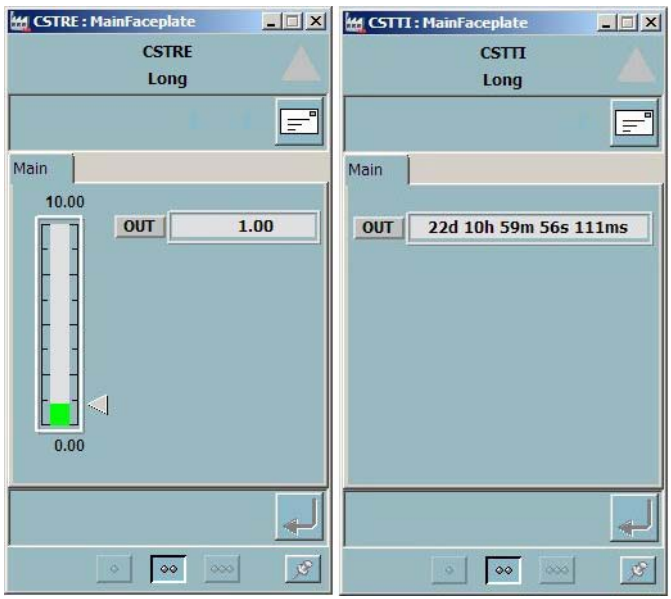

Figure 38. Input floating point, CSTRE / Input time, CSTTI

Input double integer word, CSTUD / Input integer word, CSTUI

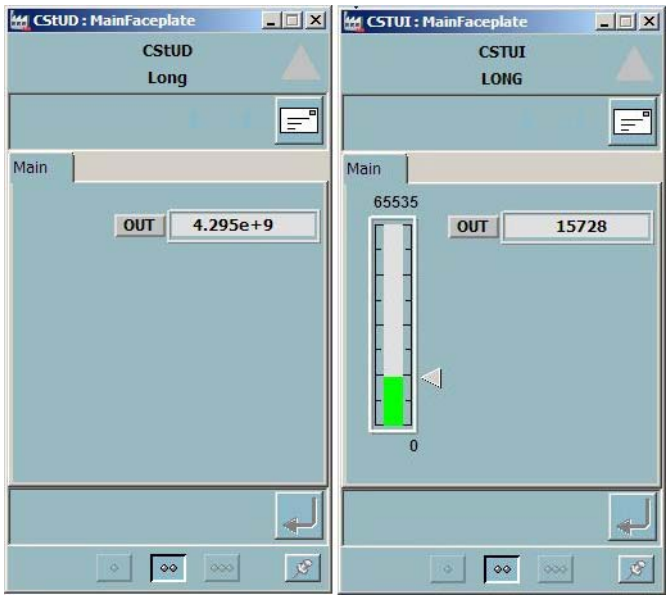

Figure 39. Input double integer word, CSTUD / Input integer word, CSTUI

Input Word, CSTWO

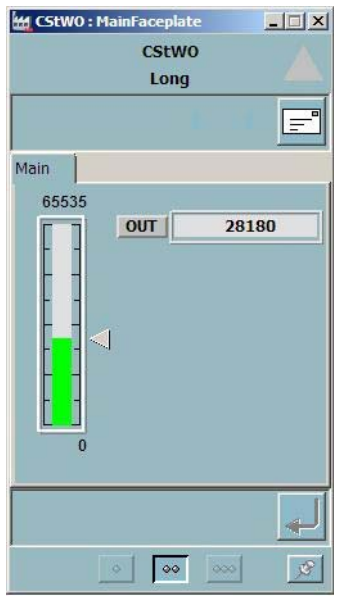

Figure 40. Input Word, CSTWO

Constant Inputs, CSTSTR8, ... , CSTSTR256

The following function block string constants are available:

Block	Data type	Max. number of characters
CSTSTR8	STRING8	8
CSTSTR16	STRING16	16
CSTSTR32	STRING32	32
CSTSTR64	STRING64	64
CSTSTR128	STRING128	128
CSTSTR256	STRING256	256

The IEC character set is supported. This includes all characters from the ISO646 Table 1 “Basic Code Table”, columns 3 to 7, also lower-case letters. Non-printing characters such as e.g. line feed are denoted by the dollar sign $ and are entered as hexadecimal characters.

Example $0D$0A corresponds to 2 characters,

0D = carriage return and

0A = line feed.

Other examples of the non-printing characters according to IEC are:

$$	Dollar sign,
$'	Apostrophe,
$P oder $p	Form feed,
$L oder $l	Line feed or $0A

$R oder $r	Carriage return or $0D,
$N oder $n	New line, end current line and begin at start of next line,
$T oder $t	Tab, with non-proportional script, forwarding is effected to the column that can be divided by 8, and the next 2 cm limit with proportional script.

Characters denoted by $ are not interpreted in the faceplates, but are displayed in the form entered,

e.g. $AB for «.

The characters known from IEC are abbreviated accordingly, e.g. $0A is displayed as $L.

Example of a faceplate (string constant):

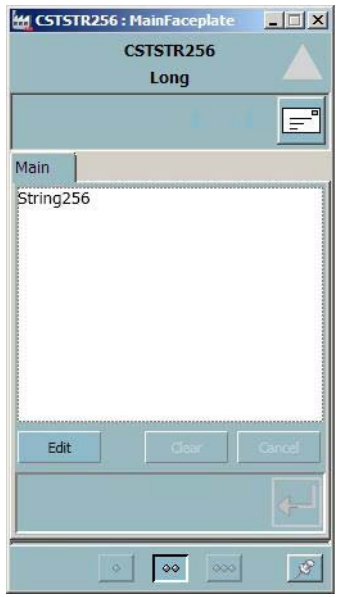

Figure 41. Example of a faceplate

Display

Name, short text and the constant value (text).

Operator interventions

Text can be entered and changed in the text area after pressing the Edit button.

Section 8 Batch Function Blocks

Phase X Control, FPX

This chapter covers the function and operation of the FPX (Freelance PhaseX) function block.

The FPX function block FPX is the interface between the batch package and the Freelance controller AC, DCP 10 etc.

The FPX block relays the commands and parameter entries of the recipe package for just one control function to a Freelance controller.

The FPX block controls the implementation of the commands and process data (parameters) from the recipe package and provides feedback on status and error status

.

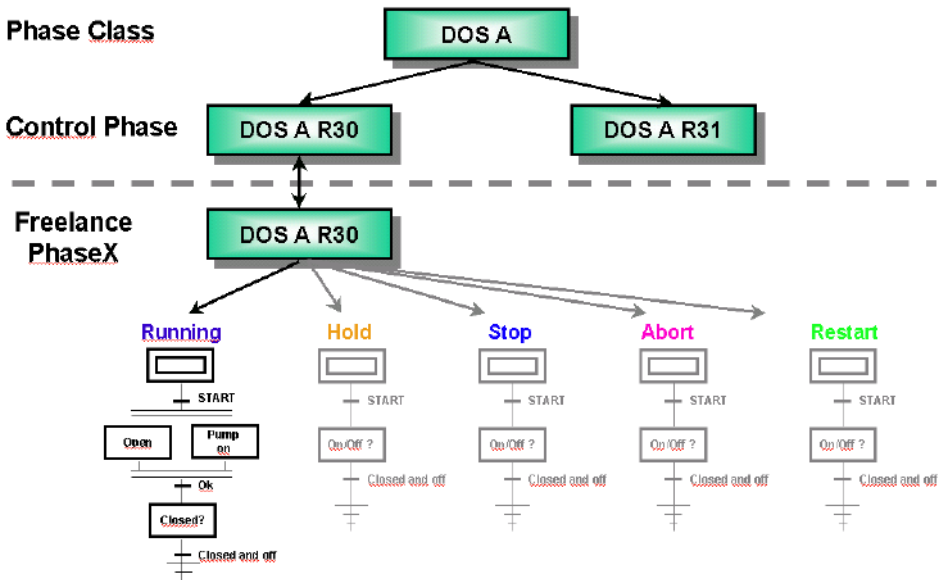

Figure 42. Phase X Control, FPX

The commands for a control function of the batch program are implemented byactivation by permanently allocated sequential control programs (sequences) in the Freelance user program. These sequential control programs are triggered by the FPX block, in which the names of the already configured sequential control programs are entered.

The following sequences are possible:

- Running sequence
- Hold sequence
- Stop sequence
- Abort sequence
- Restart sequence

The running sequence must be configured as a minimum and be made known to the FPX block. All other sequences are optional. For example, if there is a change in

command from Running to Holding, the running sequence is held at the next transition and the hold sequence is started in which the process-related controls for this case are configured.

Operator, **Program, Manual** and **Automatic** are available for selection as operating modes.

For recipe operation, **Program** and **Operator** are available.

With **Program** all commands automatically come from the recipe program. The FPX block can only be operated in **Operator**.

In **Automatic** mode, the control function, i.e. the FPX block and the subordinate sequences (sequential control programs), is processed automatically, i.e. without further operator intervention. If the operating mode is changed to **Manual**, the running running sequence (sequential control program) is switched to Manual mode and its active step action outputs are reset. It is not possible to start the running sequence in this state.

If, for example, the operator changes the value of a recipe parameter, the value is checked for overranging. If the upper or lower limit value is exceeded, a message is sent to the operator.

After the control function has been processed, the FPX block resets the Mode Attribute to Program and the operating mode to Automatic.

Phase X Faceplate

Figure 43. Phase X Faceplate

Display

The phase name *NA* is the name of the control function allocated within an operation. The phase status ST such as Running or Stopped corresponds to the current status of the phase in the recipe program. The phase number *NU* indicates the current position within the recipe program.

The name of the sequence currently being executed (sequential control program) on the Freelance controller is displayed under *PR*. If there is an error, the error code is displayed under *FA*.

The Batch Manager is responsible for the display of the Batch ID *BA*, the Recipe ID *RE*, the Lot ID *LO* and the Campaign ID *CA*. This information comes from the Scheduler and is logged accordingly.

Recipe and Param are used to switch between the display of status and recipe information and the display of the 20 recipe parameters. In the parameter display, the value of the parameter can be changed by selection of the appropriate button.

Tool tips are provided to display the full parameter text.

Status Display

The status transition diagram forms the basis for the status display and operation. Depending on the status, certain commands are possible. During the status transition, the corresponding sequence is processed on the controller. If only the running sequence is configured or only here a sequential control program is configured and allocated to the FPX block, the statuses such as stopped or held are controlled directly.

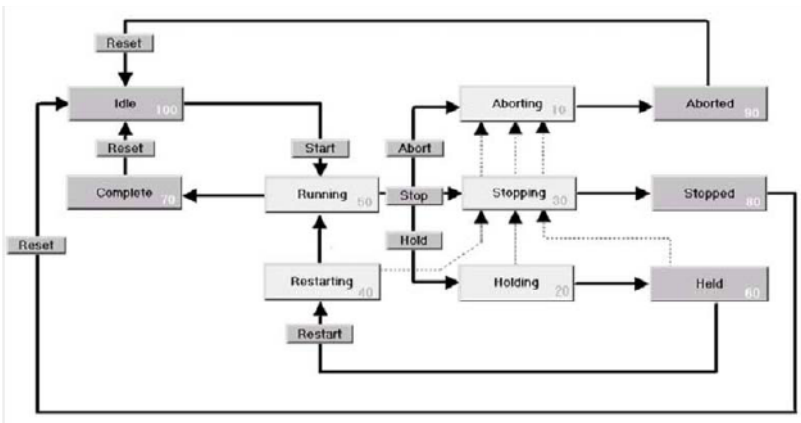

Figure 44. Status Display

Operator intervention

With the batch package, certain commands can be executed on the recipe levels and on the individual control functions.

The FPX block receives the commands and the recipe parameters from the batch package and returns the state information to the batch package.

The commands are implemented depending on the **Operator/Program** operating authorization.

In the **Operator OP** mode, commands can be given not only by the operator but also at appropriate input pins of the FPX block.

In **Program PR** operating authorisation, these commands come automatically from the batch package and are relayed via the FPX block to the control function implemented in the Freelance user program.

If the operating authorisation changes to **OP** , the higher-level recipe level switches from the batch package to the Freelance operator and it is possible to change the operating mode of the FPX block from **Automatik** to **Manual**.

The possible commands in connection with the current state of the control function and the resulting state/status changes are defined in the status transition diagram.

If the FPX block receives an unknown command or a command which does not correspond to the status transition diagram, i.e. it is not permissible with the current state of the control function/FPX, an error code is generated.

Table 2. Commands and Descriptions

Command	Description		Value
Abort	Instructs the FPX block to put the control function in the state Aborting. Execution is possible from any state apart from Idle, Complete and Stopped. If the running sequence is in the state Held (forced by a previous state change), it is reset before the start of the Abort sequence.		10
Hold	Stops the processing of the running or restart sequence; the operating mode of the sequence control? program is set to Manual and the step action outputs currently activated are reset. Executed from the state *Running* or *Restarting*.		20
Stop	Instructs the FPX block to put the control function in the state Stopping. Execution is possible from the states Running, Holding, Hold and Restarting. If the running sequence is in the state Held (forced by a previous state change), it is reset before the start of the Stop sequence.		30
Reset	Resets the control function from the state Stopped, Aborted or Complete to Idle. In Operator mode, the Reset command is issued by the FPX block internally.		40

Table 2. Commands and Descriptions (Continued)

Command	Description		Value
Pause	The operator can cause the processing of the sequence control? program to be interrupted by transmitting the command PAUSE. If the FPX block receives the command PAUSE, it writes a logic 1 signal to the output P (Pause). The batch program then goes to the next programmed pause transition which must set the input PD (Pause mode) to logic 1 signal and waits until the output P of the FPX block is reset by the command Resume before continuing with the processing.		50
Resume	Is the opposite of the command PAUSE. A batch program in the state PAUSE is to continue being processed. The FPX block resets the output P, after which the batch program resets the input PD and continues with the processing. The command is executed when the output P has been set.		80
Restart	Instructs the FPX block to switch the control function from Held to Running via Restarting.The command is executed when the control function is in the state Held and there is no error.		90
Start	Starts the running sequence. The state switches from Idle to Running. In **Program** mode, the recipe parameters of the phase are automatically loaded in the FPX block. The command is executed when the FPX block is in the state Idle and there is no error.		100
-/-	Displays list with all allocated sequences. From this list one may get directly to the SFC structure display		

Error Codes

The FPX block has 3 alarm/message inputs, *LO*, *HI* and *EM*. These alarms can be generated by the user program when errors have occurred in the sequential control program processing on the individual control level.

If there is an alarm, the recipe goes to failure.

If a value other than zero (0) is read at the error output, the error is displayed in the faceplate with its error code *FA*.

If an error occurs and if the running or restart sequence is being executed at the same time, the FPX block holds this sequence (the sequence is switched to Manual mode) and starts the Hold sequence if it has been configured.

The processing of the held sequence is only continued when the failure has been remedied (there is a zero (0) at the error output) and the PLI block has received the command RESTART.

The following table shows the possible error codes and their causes:

Table 3. Error codes and causes

Meaning	Code
No error	0
Low alarm	1
High alarm	2
Emergency alarm	3
Sequential control program cannot be operated	100
Sequential control program is not installed	101
Error in read access to sequential control program	102
Error in write access to sequential control program	103
Invalid command	104

Section 9 Sequence Control Function Blocks

Sequential Flow Chart, SFC

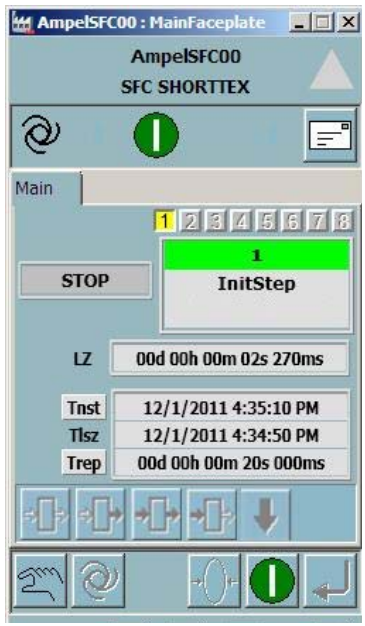

Figure 45. Sequential Flow Chart, SFC

Display

Name, short text, number of the active step, current run time of the sequence flow *tg*. Depending on the selection *ts* or *t*, step-related or sequence flow-related times are also displayed.

t selected: restart time *tnst*, last start time *tlst* and repeat time *trep*.

ts selected: Run time of the active step *ts1, ..., ts8*, residual waiting time of the active step *tw1, ..., tw8* and residual monitoring time of the active step *tu1, ..., tu8*.

Eight selection spots 1,..., 8 are arranged above the display of the step number. If more than one step is active (simultaneous flows), the corresponding number of the spots has a yellow background. By selecting the spots with a yellow background, it is possible to switch the display of the step number and the step times between the active steps. The spot selected has a blue background.

The current operating mode, Manual/Automatic, enable and the preselected inching mode are displayed by the buttons in the operator area having a yellow background.

Operator intervention

Switching the operating mode between Manual and Automatic with the buttons Man/Aut.

Preselection of inching mode:

Button Km1	Waiting time, monitoring time, actions and transitions are not activated.
Button Km2	Actions are activated.
Button Km3	Actions and transitions are activated.
Button Km4	Transitions are activated.

The sequence flow is enabled with the button Enable. In Manual mode, the sequence flow can be stepped (CarryOut button) or reset (Reset button).

Changing the restart time *tnst* and the repeat time *trep*.

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