System 800xA

800xA for Freelance Operation

System Version 6.0
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About This User Manual

General

Any security measures described in this User Manual, for example, for user access, password security, network security, firewalls, virus protection, etc., represent possible steps that a user of an 800xA System may want to consider based on a risk assessment for a particular application and installation. This risk assessment, as well as the proper implementation, configuration, installation, operation, administration, and maintenance of all relevant security related equipment, software, and procedures, are the responsibility of the user of the 800xA System.

This User Manual describes the operation and display of the functions, function blocks and variables specific to 800xA for Freelance. 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.

User Manual Conventions

Microsoft Windows conventions are normally used for the standard presentation of material when entering text, key sequences, prompts, messages, menu items, screen elements, etc

Warning, Caution, Information, and Tip Icons

This User Manual 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 that could result in *electrical shock*.
- Warning icon indicates the presence of a hazard that could result in *personal injury*.
- Caution icon indicates important information or warning related to the concept discussed in the text. It might indicate the presence of a hazard that 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, fully comply with all Warning and Caution notices.

### 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.

<table>
<thead>
<tr>
<th>Term/Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AE</td>
<td>OPC Alarms and Events</td>
</tr>
<tr>
<td>CBF</td>
<td>Freelance engineering tool Control Builder F</td>
</tr>
<tr>
<td>DA</td>
<td>OPC Data Access</td>
</tr>
</tbody>
</table>
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>
<thead>
<tr>
<th>Category</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connectivity</td>
<td>800xA for Freelance, Release Notes</td>
<td>2PAA112403*</td>
</tr>
<tr>
<td></td>
<td>800xA for Freelance, Configuration</td>
<td>3BDD011812*</td>
</tr>
<tr>
<td></td>
<td>800xA for Freelance, Installation</td>
<td>3BDD011810*</td>
</tr>
<tr>
<td>800xA System</td>
<td>System 800xA Language Pack Installation</td>
<td>2PAA102031*</td>
</tr>
<tr>
<td></td>
<td>System 800xA 6.0 Manual Installation</td>
<td>2PAA112455*</td>
</tr>
<tr>
<td></td>
<td>System 800xA 5.1 to 6.0 Upgrade</td>
<td>2PAA111694*</td>
</tr>
<tr>
<td></td>
<td>System 800xA 5.0 SP2 to 6.0 Upgrade</td>
<td>2PAA111695*</td>
</tr>
<tr>
<td></td>
<td>6.0, Release Notes Known Problems</td>
<td>2PAA111899*</td>
</tr>
<tr>
<td></td>
<td>6.0, Release Notes Fixed Problems</td>
<td>2PAA112277*</td>
</tr>
<tr>
<td>Freelance</td>
<td>Freelance 2013, Release Notes</td>
<td>2PAA103593*</td>
</tr>
<tr>
<td></td>
<td>Freelance 2013 Rollup1, Release Notes</td>
<td>2PAA105400R0901</td>
</tr>
</tbody>
</table>

**Term/Acronym**

<table>
<thead>
<tr>
<th>Term/Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPC</td>
<td>OLE for Process Control</td>
</tr>
<tr>
<td>PLC file</td>
<td>Standard file format for Progammable Logic Control</td>
</tr>
<tr>
<td>SFC</td>
<td>Freelance Sequential Function Chart</td>
</tr>
</tbody>
</table>
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](image)
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.
View Selection Buttons

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

<table>
<thead>
<tr>
<th>Status</th>
<th>Signalling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not active</td>
<td>Background color grey</td>
</tr>
<tr>
<td>Active</td>
<td>Background color yellow</td>
</tr>
<tr>
<td>Activated (must be</td>
<td>Background color green</td>
</tr>
<tr>
<td>confirmed)</td>
<td></td>
</tr>
<tr>
<td>Operable</td>
<td>Symbol color black</td>
</tr>
<tr>
<td>Not operable</td>
<td>Symbol color grey</td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>Button</th>
<th>Designation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>![button]</td>
<td>Aut</td>
<td>Automatic</td>
</tr>
<tr>
<td>![button]</td>
<td>Man</td>
<td>Manual</td>
</tr>
<tr>
<td>![button]</td>
<td>Ext</td>
<td>External Value</td>
</tr>
<tr>
<td>Operator</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
<td></td>
</tr>
<tr>
<td>Int</td>
<td>Internal Value</td>
<td></td>
</tr>
<tr>
<td>On</td>
<td>On/off Command</td>
<td></td>
</tr>
<tr>
<td>Off</td>
<td>Off/on Command</td>
<td></td>
</tr>
<tr>
<td>Stop</td>
<td>Stop Command</td>
<td></td>
</tr>
<tr>
<td>Reset</td>
<td>Reset</td>
<td></td>
</tr>
<tr>
<td>Coarse</td>
<td>Coarsing dosing command</td>
<td></td>
</tr>
<tr>
<td>Fine</td>
<td>Fine dosing command</td>
<td></td>
</tr>
<tr>
<td>ValveClose</td>
<td>Dosing off</td>
<td></td>
</tr>
<tr>
<td>SpUp</td>
<td>Setpoint Up</td>
<td></td>
</tr>
<tr>
<td>SpDown</td>
<td>Setpoint Down</td>
<td></td>
</tr>
<tr>
<td>OutUp</td>
<td>Output Up</td>
<td></td>
</tr>
<tr>
<td>OutDown</td>
<td>Output Down</td>
<td></td>
</tr>
<tr>
<td>Ratio</td>
<td>Ratio controller switchover (controller)</td>
<td></td>
</tr>
<tr>
<td>Icon</td>
<td>Label</td>
<td>Description</td>
</tr>
<tr>
<td>------</td>
<td>-------</td>
<td>-------------</td>
</tr>
<tr>
<td>SP</td>
<td>Fixed set point controller switchover (controller)</td>
<td></td>
</tr>
<tr>
<td>CarryOut</td>
<td>Continue inching (SFC)</td>
<td></td>
</tr>
<tr>
<td>Km1</td>
<td>Select inching mode 1 (SFC)</td>
<td></td>
</tr>
<tr>
<td>Km2</td>
<td>Select inching mode 2 (SFC)</td>
<td></td>
</tr>
<tr>
<td>Km3</td>
<td>Select inching mode 3 (SFC)</td>
<td></td>
</tr>
<tr>
<td>Km4</td>
<td>Select inching mode 4 (SFC)</td>
<td></td>
</tr>
<tr>
<td>Skip</td>
<td>Skip (scheduler)</td>
<td></td>
</tr>
<tr>
<td>Scroll</td>
<td>Scroll (scheduler)</td>
<td></td>
</tr>
<tr>
<td>NumCyc</td>
<td>Operation of a certain number of cycles (scheduler)</td>
<td></td>
</tr>
<tr>
<td>Perm</td>
<td>Permanent operation/continuous operation (scheduler)</td>
<td></td>
</tr>
<tr>
<td>Tune1</td>
<td>Step response stationary</td>
<td></td>
</tr>
<tr>
<td>Tune2</td>
<td>User defined parameter set</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tune3</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>-------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tune4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tune5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tune6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tune7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tune8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tune9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tune10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dec1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dec3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dec10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inc1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inc3</td>
</tr>
<tr>
<td>Inc10</td>
<td>Increment 10</td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>--------------</td>
<td></td>
</tr>
<tr>
<td>Return</td>
<td>Confirmation/Apply</td>
<td></td>
</tr>
</tbody>
</table>
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:

<table>
<thead>
<tr>
<th>Button</th>
<th>Designation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Operator Log]</td>
<td>Operator Log</td>
<td></td>
</tr>
<tr>
<td>![Alarm]</td>
<td>Alarm</td>
<td>Alarm Active</td>
</tr>
<tr>
<td>![Alarm]</td>
<td>Alarm</td>
<td>Alarm Acknowledged</td>
</tr>
<tr>
<td>![Alarm]</td>
<td>Alarm</td>
<td>Alarm Hidden</td>
</tr>
</tbody>
</table>
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 Input Transformation (transient), AI_TRT

Figure 6. Analog Input Transformation (transient)

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

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

Figure 7. Analog Output Transformation
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.

Figure 8. Counter with Analog Input, CT_ANA
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

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.
If negation range varies from -9999 to +9, then the negation (-) symbol is displayed on the Faceplate of C_ANA Function block.

**Time Scheduler, TS**

![Time Scheduler Faceplate](image)

*Figure 10. Time Scheduler*

**Display**

Name, short text, scale range.

In the faceplate of the time scheduler the current output value \textit{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.
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.

<table>
<thead>
<tr>
<th>Display</th>
<th>Act selected</th>
<th>Nom selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sec</td>
<td>Number of the actual section</td>
<td>Number of configured section</td>
</tr>
<tr>
<td>T</td>
<td>Running time since the start of a time plan</td>
<td>Time marker of the nominal curve</td>
</tr>
<tr>
<td>Cyc</td>
<td>Number of the actual run</td>
<td>Number of configured run cycles</td>
</tr>
<tr>
<td>Off</td>
<td>-/-</td>
<td>Offset time scheduler</td>
</tr>
</tbody>
</table>
Section 3  Binary Function Blocks

Time Counter, CTT

Figure 11. Time Counter, CTT
Display
Name, short text, the current counter reading \(Z_L\) and the counter reading of the last period \(Z_P\) as bar and numerical values. Up to two limit values \(L_1, L_2\) as numerical values and markers on the bar.

Operator interventions
Changing the limit values \(L_1, L_2\) and Resetting of the time value output to 0.
Message acknowledgement.
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

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

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

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

Operator Interventions
None
**Monoflop, MONO_F**

![Monoflop, MONO_F](image)

*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

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](image)

**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

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.

Figure 19. External Input, Timer


**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](image)

**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
**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

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

Operator interventions
Message acknowledgement.
Binary, M_BIN

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

Operator interventions
Message acknowledgement.

Figure 24. Binary, M_BIN
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

Figure 26. Universal, C_CU Main Tab
Universal, C_CU

Figure 27. Universal, C_CU Limits Tab
Standard, C_CS

Figure 28. Standard, C_CS Main Tab
Figure 29. Standard, C_CS Limits Tab
Ratio, C_CR

Figure 30. Ratio, C_CR Main Tab
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.

<table>
<thead>
<tr>
<th>Fixed value controller</th>
<th>Display</th>
<th>Process value bar chart</th>
<th>Set point bar chart</th>
</tr>
</thead>
<tbody>
<tr>
<td>Media</td>
<td>PV</td>
<td>W_{internal}</td>
<td></td>
</tr>
<tr>
<td>Ratio</td>
<td>RV = (PV-B) / (W_{ext} * L)</td>
<td>R</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ratio controller</th>
<th>Display</th>
<th>Process value bar chart</th>
<th>Set point bar chart</th>
</tr>
</thead>
<tbody>
<tr>
<td>Media</td>
<td>PV</td>
<td>W_{ext} * R * L + B</td>
<td></td>
</tr>
<tr>
<td>Ratio</td>
<td>RV = (PV-B) / (W_{ext} * L)</td>
<td>R</td>
<td></td>
</tr>
</tbody>
</table>

**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.

Users having Operator or System Engineer rights are not allowed to change the tuning parameters.

Users should be a part of Application Engineer or Administrator group to change the tuning parameters.

Default 800xA users (800xA installer or 800xA service or Administrator) are allowed to change the tuning parameters.
Tune parameters tab

**Controller Parameters (CP):** Proportional correction value CP, entered as REAL number, range 0.0 < CD < 1000.0.

**TR:** Reset time TR, entered in TIME format, range TR > 0 ms,

**TD:** Rate time, entered in TIME format, range TD > 0 ms.

**CD:** The effective D branch is calculated from CD. D branch. CD entered as a REAL number, range 0.0 < CD < 20.0.

**Tsync:** Stabilizing time for PT1 action entered in TIME format, range Tsync > 0 ms.

The Tuning parameters changed through controller faceplates are only stored in the controller variables (only Written) and not stored in CBF project (Not corrected).

PID parameters tab

Controller branch P and/or I

**P branch:** P branch in control algorithm is effective.

**I branch:** I branch in control algorithm is effective.

**Inverse char:** The inverse characteristic deviation CE is processed.

**Valve char. rising:** Valve characteristic rising,

i.e. OUT = 0% valve closed, OUT = 100% valve open, OV = OUT

**Valve characteristic rising.**

i.e. OUT = 100% valve closed, OUT = 0%

valve open, OV = 100%-OUT, OUT = 100%-internal variable

**CP-var. peakless:** In the case of a configuration without an I branch the variable passes through a PT1 state to the current value when the CP value is altered. In a
configuration without an I branch the variable takes on the current value when the CP value is altered.

D-action:
On: Effective with positive and negative change in control difference.
Positive: Effective only with positive change in control difference.
Negative: Effective only with negative change in control difference.
Off: D branch not effective.
disturbance feed-forward to:
PV: Disturbance DTB influences controlled variable.
Out: Disturbance DTB influences output variable.
CE: Disturbance DTB influences deviation.

D-action:
Off: Indicates whether the D branch is calculated from the controlled variable or control difference.
PV: D branch based on controlled variable.
CE: D branch based on control difference.

P-action:
Off: Indicates whether the P branch affects the controlled variable PV or the control difference CE. Selection of PV causes attenuation of the output variable OUT when command values change.
PV: P branch influences controlled variable PV.
CE: P branch influences control difference CE.

Operating point:
Only for configurations without I branch. Output variable OUT entered as percentage with a deviation of CE from 0. Entered as a REAL number.
**Monit. disturbance**

This parameter controls the effect of a disturbance variable on the display of the variables PV (controlled variable), CE (control difference) and RV (actual ratio) in the group display (PV, RV), in the overview display (CE) and at the block output (CE, RV). Furthermore, the effect of the disturbance variable on the limit value monitoring of controlled variable PV, control difference CE and actual ratio RV is also fixed.

Refer to 3BDD012514_Eng_Ref_Manual_Functions_FB's manual for Tuning and PID parameters limits.
Step Controllers

Universal, C_SU

Figure 32. Universal, C_SU Main Tab
Figure 33. Universal, C_SU Limits Tab
Figure 34. Standard, C_SS Main Tab
Figure 35. Standard, C_SS Limits Tab
Ratio, C_SR

Figure 36. Ratio, C_SR Main Tab
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.

Users having Operator or System Engineer rights are not allowed to change the tuning parameters.

Users should be a part of Application Engineer or Administrator group to change the tuning parameters.

Default 800xA users (800xA installer or 800xA service or Administrator) are allowed to change the tuning parameters.

**Tune parameters tab**

**Controller Parameters (CP):** Proportional correction value CP, entered as REAL number, range 0.0< CD <1000.0.

**TR:** Reset time TR, entered in TIME format, range TR > 0 ms,

**TD:** Rate time, entered in TIME format, range TD 0 > ms.

**CD:** The effective D branch is calculated from CD.D branch. CD entered as a REAL number, range 0.0 < CD < 20.0.
**Tsync**: Stabilizing time for PT1 action entered in TIME format, range Tsync > 0 ms.

The Tuning parameters changed through controller faceplates are only stored in the controller variables (only Written) and not stored in CBF project (Not corrected).

**PID parameters tab**

Controller branch P and/or I

**P branch**: P branch in control algorithm is effective.

**I branch**: I branch in control algorithm is effective.

**Inverse char**: The inverse characteristic deviation CE is processed.

**Valve char. rising**: Valve characteristic rising,

- i.e. OUT = 0% valve closed, OUT = 100% valve open, OV = OUT

**Valve characteristic rising**,

- i.e. OUT = 100% valve closed, OUT = 0% valve open, OV = 100%-OUT, OUT = 100%-internal variable

**CP-var. peakless**: In the case of a configuration without an I branch the variable passes through a PT1 state to the current value when the CP value is altered. In a configuration without an I branch the variable takes on the current value when the CP value is altered.

**External feed-back**

Control algorithm works with external feed-back signal.

Control algorithm works with internal feed-back signal.

**D-action:**

**On**: Effective with positive and negative change in control difference.

**Positive**: Effective only with positive change in control difference.

**Negative**: Effective only with negative change in control difference.
Section 5  Controller Function Blocks

Off: D branch not effective.

Disturbance feed-forward to:
PV: Disturbance DTB influences controlled variable.
Out: Disturbance DTB influences output variable.
CE: Disturbance DTB influences deviation.

D-action:
Off: Indicates whether the D branch is calculated from the controlled variable or control difference.
PV: D branch based on controlled variable.
CE: D branch based on control difference.

P-action:
Off: Indicates whether the P branch affects the controlled variable PV or the control difference CE. Selection of PV causes attenuation of the output variable OUT when command values change.
PV: P branch influences controlled variable PV.
CE: P branch influences control difference CE.

Operating point:
Only for configurations without I branch. Output variable OUT entered as percentage with a deviation of CE from 0. Entered as a REAL number.

Monit. disturbance
This parameter controls the effect of a disturbance variable on the display of the variables PV (controlled variable), CE (control difference) and RV (actual ratio) in the group display (PV, RV), in the overview display (CE) and at the block output (CE, RV). Furthermore, the effect of the disturbance variable on the limit value monitoring of controlled variable PV, control difference CE and actual ratio RV is also fixed.

Refer to 3BDD012514_Eng_Ref_Manual_Functions_FB's manual for Tuning and PID parameters limits.
Two Position Controllers

Universal, C_OU

Figure 38. Universal, C_OU Main Tab
Figure 39. Universal, C_OU Limits Tab
Figure 40. Standard, C_OS, Main Tab
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.

Users having Operator or System Engineer rights are not allowed to change the tuning parameters.

Users should be a part of Application Engineer or Administrator group to change the tuning parameters.

Default 800xA users (800xA installer or 800xA service or Administrator) are allowed to change the tuning parameters.

**Tune parameters tab**

**Controller Parameters (CP):** Proportional correction value CP, entered as REAL number, range 0.0< CD < 1000.0.

**TR:** Reset time TR, entered in TIME format, range TR > 0 ms,
Section 5  Controller Function Blocks  

**TD:** Rate time, entered in TIME format, range $TD \geq 0$ ms.

**CD:** The effective $D$ branch is calculated from $CD$. $CD$ branch. $CD$ entered as a REAL number, range $0.0 < CD < 20.0$.

**Tsync:** Stabilizing time for PT1 action entered in TIME format, range $Tsync > 0$ ms.

The Tuning parameters changed through controller faceplates are only stored in the controller variables (only Written) and not stored in CBF project (Not corrected).

**PID parameters tab**

Controller branch $P$ and/or $I$

**P branch:** $P$ branch in control algorithm is effective.

**I branch:** $I$ branch in control algorithm is effective.

**Inverse char:** The inverse characteristic deviation $CE$ is processed.

**Valve char. rising:** Valve characteristic rising,

i.e. $OUT = 0\%$ valve closed, $OUT = 100\%$

valve open, $OV = OUT$

**Valve characteristic rising,**

i.e. $OUT = 100\%$ valve closed, $OUT = 0\%$

valve open, $OV = 100\%-OUT$, $OUT = 100\%-internal$ variable

**CP-var. peakless:** In the case of a configuration without an $I$ branch the variable passes through a PT1 state to the current value when the CP value is altered. In a configuration without an $I$ branch the variable takes on the current value when the CP value is altered.

**External feed-back**

Control algorithm works with external feed-back signal.

Control algorithm works with internal feed-back signal.
**D-action:**

**On:** Effective with positive and negative change in control difference.

**Positive:** Effective only with positive change in control difference.

**Negative:** Effective only with negative change in control difference.

**Off:** D branch not effective.

disturbance feed-forward to:

**PV:** Disturbance DTB influences controlled variable.

**Out:** Disturbance DTB influences output variable.

**CE:** Disturbance DTB influences deviation.

**D-action:**

**Off:** Indicates whether the D branch is calculated from the controlled variable or control difference.

**PV:** D branch based on controlled variable.

**CE:** D branch based on control difference.

**P-action:**

**Off:** Indicates whether the P branch affects the controlled variable PV or the control difference CE. Selection of PV causes attenuation of the output variable OUT when command values change.

**PV:** P branch influences controlled variable PV.

**CE:** P branch influences control difference CE.

**Operating point:**

Only for configurations without I branch. Output variable OUT entered as percentage with a deviation of CE from 0. Entered as a REAL number.

**Monit. disturbance**

This parameter controls the effect of a disturbance variable on the display of the variables PV (controlled variable), CE (control difference) and RV (actual ratio) in the group display (PV, RV), in the overview display (CE) and at the block output (CE, RV). Furthermore, the effect of the disturbance variable on the limit value
monitoring of controlled variable PV, control difference CE and actual ratio RV is also fixed.

Refer 3BDD012514_Eng_Ref_Manual_Functions_FB's manual for Tuning and PID parameters limits.
Three Position Controllers

Universal, C_PU

Figure 42. Universal, C_PU Main Tab
Figure 43. Universal, C_PU Limits Tab
Figure 44. Standard, C_PS Main Tab
Section 5  Controller Function Blocks

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.

Figure 45. Standard, C_PS Limits Tab
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.

Users having Operator or System Engineer rights are not allowed to change the tuning parameters.

Users should be a part of Application Engineer or Administrator group to change the tuning parameters.

Default 800xA users (800xA installer or 800xA service or Administrator) are allowed to change the tuning parameters.

**Tune parameters tab**

**Controller Parameters (CP):** Proportional correction value CP, entered as REAL number, range 0.0 < CD < 1000.0.

**TR:** Reset time TR, entered in TIME format, range TR > 0 ms,
TD: Rate time, entered in TIME format, range TD \( 0 > \) ms.

CD: The effective D branch is calculated from CD.D branch. CD entered as a REAL number, range \( 0.0 < CD < 20.0 \).

Tsync: Stabilizing time for PT1 action entered in TIME format, range Tsync \( > 0 \) ms.

The Tuning parameters changed through controller faceplates are only stored in the controller variables (only Written) and not stored in CBF project (Not corrected).

**PID parameters tab**

Controller branch P and/or I

**P branch:** P branch in control algorithm is effective.

**I branch:** I branch in control algorithm is effective.

**Inverse char:** The inverse characteristic deviation CE is processed.

**Valve char. rising:** Valve characteristic rising,

i.e. \( \text{OUT} = 0\% \) valve closed, \( \text{OUT} = 100\% \) valve open, \( \text{OV} = \text{OUT} \)

**Valve characteristic rising,**

i.e. \( \text{OUT} = 100\% \) valve closed, \( \text{OUT} = 0\% \) valve open, \( \text{OV} = 100\%-\text{OUT} \), \( \text{OUT} = 100\%-\text{internal variable} \)

**CP-var. peakless:** In the case of a configuration without an I branch the variable passes through a PT1 state to the current value when the CP value is altered. In a configuration without an I branch the variable takes on the current value when the CP value is altered.

**D-action:**

**On:** Effective with positive and negative change in control difference.

**Positive:** Effective only with positive change in control difference.
Negative: Effective only with negative change in control difference.
Off: D branch not effective.
disturbance feed-forward to:
PV: Disturbance DTB influences controlled variable.
Out: Disturbance DTB influences output variable.
CE: Disturbance DTB influences deviation.

D-action:
Off: Indicates whether the D branch is calculated from the controlled variable or control difference.
PV: D branch based on controlled variable.
CE: D branch based on control difference.

P-action:
Off: Indicates whether the P branch affects the controlled variable PV or the control difference CE. Selection of PV causes attenuation of the output variable OUT when command values change.
PV: P branch influences controlled variable PV.
CE: P branch influences control difference CE.

Operating point:
Only for configurations without I branch. Output variable OUT entered as percentage with a deviation of CE from 0. Entered as a REAL number.

Monit. disturbance
This parameter controls the effect of a disturbance variable on the display of the variables PV (controlled variable), CE (control difference) and RV (actual ratio) in the group display (PV, RV), in the overview display (CE) and at the block output (CE, RV). Furthermore, the effect of the disturbance variable on the limit value monitoring of controlled variable PV, control difference CE and actual ratio RV is also fixed.
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.

Refer 3BDD012514_Eng_Ref_Manual_Functions_FB's manual for Tuning and PID parameters limits.

Figure 46. Self-tune controller, TUNE
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.

Users having Operator or System Engineer rights are not allowed to change the tuning parameters.

Users should be a part of Application Engineer or Administrator group to change the tuning parameters.

Default 800xA users (800xA installer or 800xA service or Administrator) are allowed to change the tuning parameters.
Section 6  Open Loop Control Function Blocks

Individual Drive Functions

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

Figure 47. 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**

![Dosing Circuits](image)

*Figure 48. 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 49. Input Boolean, CSTBO / Input Byte, CSTBY
Input Double Integer, CSTDI / Input Date and Time CSTDT

Figure 50. Input double integer, CSTDI / Input date and time CSTDT
Input Double Word, CSTDW / Input Integer, CSTIN

Figure 51. Input Double Word, CSTDW / Input Integer, CSTIN
Section 7  Constant Function Blocks

Input floating point, CSTRE / Input time, CSTTI

Figure 52. Input floating point, CSTRE / Input time, CSTTI
Input double integer word, CSTUD / Input integer word, CSTUI

Figure 53. Input double integer word, CSTUD / Input integer word, CSTUI
Input Word, CSTWO

Figure 54. Input Word, CSTWO
**Constant Inputs, CSTSTR8, ...... , CSTSTR256**

The following function block string constants are available:

<table>
<thead>
<tr>
<th>Block</th>
<th>Data type</th>
<th>Max. number of characters</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSTSTR8</td>
<td>STRING8</td>
<td>8</td>
</tr>
<tr>
<td>CSTSTR16</td>
<td>STRING16</td>
<td>16</td>
</tr>
<tr>
<td>CSTSTR32</td>
<td>STRING32</td>
<td>32</td>
</tr>
<tr>
<td>CSTSTR64</td>
<td>STRING64</td>
<td>64</td>
</tr>
<tr>
<td>CSTSTR128</td>
<td>STRING128</td>
<td>128</td>
</tr>
<tr>
<td>CSTSTR256</td>
<td>STRING256</td>
<td>256</td>
</tr>
</tbody>
</table>

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:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>$$</td>
<td>Dollar sign,</td>
</tr>
<tr>
<td>$'</td>
<td>Apostrophe,</td>
</tr>
<tr>
<td>$P oder $p</td>
<td>Form feed,</td>
</tr>
<tr>
<td>$L oder $l</td>
<td>Line feed or $0A</td>
</tr>
</tbody>
</table>
### Section 7  Constant Function Blocks

#### Constant Inputs, CSTSTR8, ......, CSTSTR256

<table>
<thead>
<tr>
<th>Character</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R$ or $r$</td>
<td>Carriage return or $0D$,</td>
</tr>
<tr>
<td>$N$ or $n$</td>
<td>New line, end current line and begin at start of next line,</td>
</tr>
<tr>
<td>$T$ or $t$</td>
<td>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.</td>
</tr>
</tbody>
</table>

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

\[ e.g. \; \$AB \text{ for } «. \]

The characters known from IEC are abbreviated accordingly, e.g. $0A$ is displayed as $0L$. 
Example of a faceplate (string constant):

![Figure 55. Example of a faceplate](image)

**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 900F, AC 800F, 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 (for example AC 900F, AC 800F).

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.
The commands for a control function of the batch program are implemented by activation 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

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 EA.

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.

![Status Display Diagram](image)

*Figure 58. 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 1. Commands and Descriptions**

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abort</td>
<td>Instructs the FPX block to put the control function in the state Aborting. Execution is possible from</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>any state apart from Idle, Complete and Stopped. If the running sequence is in the state Held</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(forced by a previous state change), it is reset before the start of the Abort sequence.</td>
<td></td>
</tr>
<tr>
<td>Hold</td>
<td>Stops the processing of the running or restart sequence; the operating mode of the sequence control?</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>program is set to Manual and the step action outputs currently activated are reset. Executed from the</td>
<td></td>
</tr>
<tr>
<td></td>
<td>state <em>Running or Restarting</em>.</td>
<td></td>
</tr>
</tbody>
</table>
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.

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.

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.

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.

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stop</td>
<td>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.</td>
<td>30</td>
</tr>
<tr>
<td>Reset</td>
<td>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.</td>
<td>40</td>
</tr>
<tr>
<td>Pause</td>
<td>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.</td>
<td>50</td>
</tr>
<tr>
<td>Resume</td>
<td>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.</td>
<td>80</td>
</tr>
</tbody>
</table>
Error Codes

The FPX block has 3 alarm/message inputs, \textit{LO}, \textit{HI} and \textit{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 \textit{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 \textit{RESTART}.

\begin{table}[h]
\centering
\begin{tabular}{|c|p{10cm}|c|}
\hline
Command & Description & Value \\
\hline
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 \\
\hline
Start & Starts the running sequence. The state switches from Idle to Running. In \textbf{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 \\
\hline
-/- & Displays list with all allocated sequences. From this list one may get directly to the SFC structure display & \\
\hline
\end{tabular}
\caption{Commands and Descriptions (Continued)}
\end{table}
The following table shows the possible error codes and their causes:

*Table 2. Error codes and causes*

<table>
<thead>
<tr>
<th>Meaning</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>No error</td>
<td>0</td>
</tr>
<tr>
<td>Low alarm</td>
<td>1</td>
</tr>
<tr>
<td>High alarm</td>
<td>2</td>
</tr>
<tr>
<td>Emergency alarm</td>
<td>3</td>
</tr>
<tr>
<td>Sequential control program cannot be operated</td>
<td>100</td>
</tr>
<tr>
<td>Sequential control program is not installed</td>
<td>101</td>
</tr>
<tr>
<td>Error in read access to sequential control program</td>
<td>102</td>
</tr>
<tr>
<td>Error in write access to sequential control program</td>
<td>103</td>
</tr>
<tr>
<td>Invalid command</td>
<td>104</td>
</tr>
</tbody>
</table>
Section 9  Sequence Control Function Blocks

Sequential Flow Chart, SFC

Figure 59. Sequential Flow Chart, SFC
Display
Name, short text, number of the active step, current run time of the sequence flow \( t_g \). Depending on the selection \( ts \) or \( t \), step-related or sequence flow-related times are also displayed.

\( t \) selected: restart time \( t_{nst} \), last start time \( t_{lst} \) and repeat time \( t_{rerp} \).

\( ts \) 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 \( t_{nst} \) and the repeat time \( t_{rerp} \).