ABB

VERSION 6.1/3

Minerals Library Product Guide
Control and Operation – Minerals Library

Contents

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1. Overview and Product Description

The ABB Ability System 800xA Minerals Process Control Library (MinLib) is a tailor-made automation solution for the mining and cement industries. It's an extensive set of software modules designed to achieve the highest plant productivity, availability & safety, and the best operator efficiency. The following figure illustrates that the Minerals library is an extension to 800xA automation platform.

Figure 1 - Minerals Library context

ABB's System 800xA extended Automation Platform controls more than 10'000 industrial plants worldwide. The process control library captures several decades of know-how in the mining and cement industries and encapsulates it into a ready-to-use solution.

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Figure 2 - Traditional MinLib process display example (traditional graphic)

Figure 3 - MinLib process display with VisualControl (available after 6p1s0)

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❶ Analog and digital signals, input or output displayed as value or alarm text ❷ Consumer module that can be adjusted to different shapes (e.g. fan, motor, belt, etc.) ❸ Group objects, inserted to start and stop consumers in a predefined order ❹ Loop (PID) and recipe control

The MinLib contains core control modules to handle the basic functionalities to efficiently control any continuous production processes. The control modules types, structured data types, project constants are used in the MinLib to maximize the reusability, flexibility and achieve high controller performance.

Figure 4 - MinLib Libraries in CBM and example of typical application

Minerals Library is a complete and comprehensive library for building industrial applications in System 800xA with AC800M and AC450 connectivity. Originally developed for building control applications specific to the cement industry, it has since gained widespread use in other industries such as mining, mineral processing, food and beverage, energy and metals industries, etc. with a total of over 450 instances.

1.1. Benefits of using Minerals Library

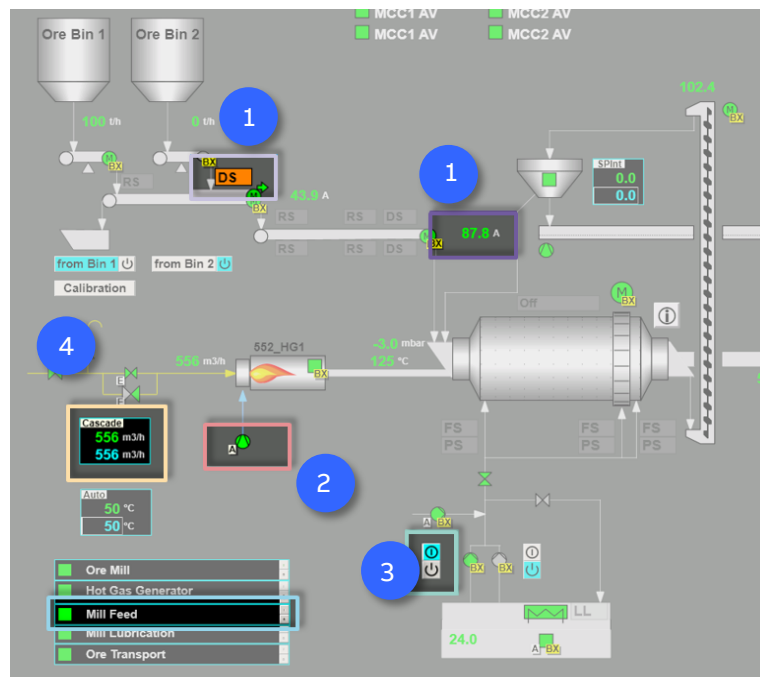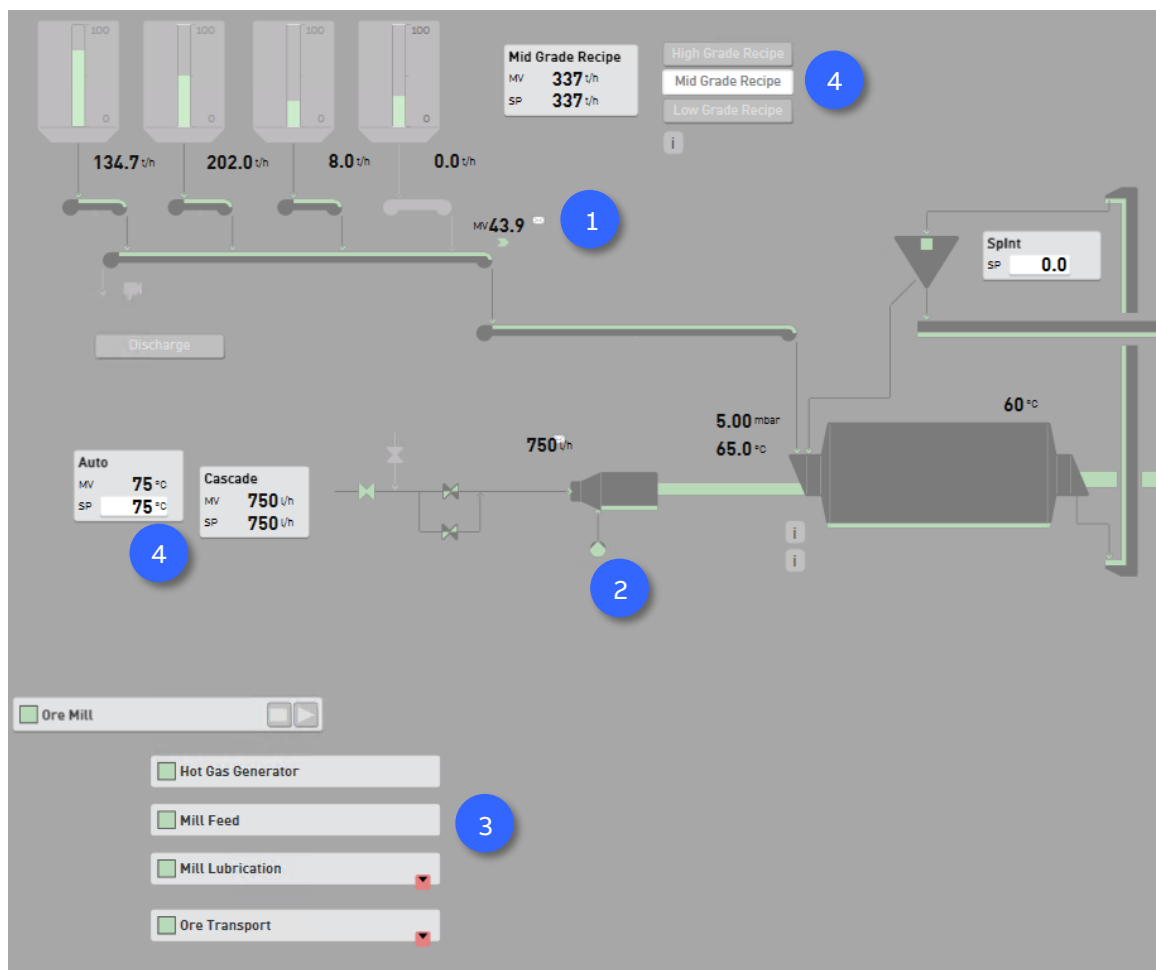Thanks to a continuously growing level of automation and intercommunication, fewer people can nowadays manage much larger plant areas. This is very likely to add complexity to daily plant operation and is therefore increasingly demanding for today's control room personal. For several years the Minerals Library has been developed, maintained, and extended with the important mission to control and optimize the 3 human loops of a modern DCS (Figure *10*).

The Minerals Library functionalities include among others:

– Fully integrated with ABB System 800xA

– Complies with international standard for programmable logic controls (IED61131-3)

– Standardized, reusable and flexible out of the box solutions

– Provides standard displays and logic that can be easily duplicated and reused.

– Easily adaptable to users' needs and/or process requirements (e.g. customization of colors, alarm and event list, etc.).

– integrated of information viewers for interlocks, sequence steps, etc.

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- The parametrized software modules enable an optimized use of efficient bulk engineering tools (combined E&I - EBase from Aucotec)

- Multi language support

- The Minerals Library comprises of the following 4 components, shown in the following figure and that are subjects of the next subchapters.
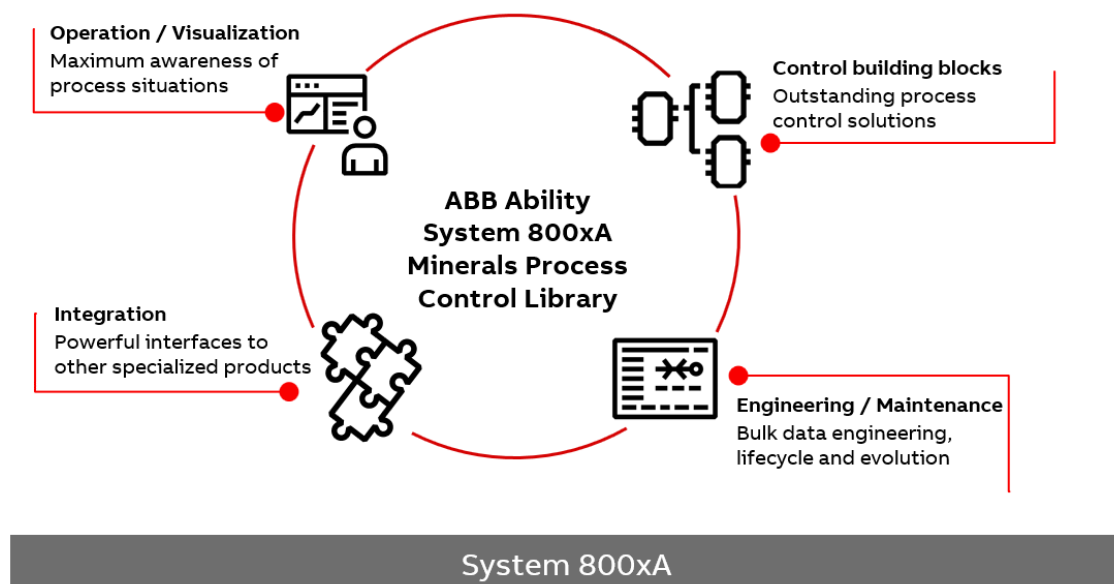
Operation / Visualization
Maximum awareness of process situations

Control building blocks
Outstanding process control solutions

ABB Ability System 800xA Minerals Process Control Library

Integration
Powerful interfaces to other specialized products

Engineering / Maintenance
Bulk data engineering, lifecycle and evolution

System 800xA

Figure 5 - Minerals Library components

Minerals Process Control Library
Building blocks

Operation / Visualization

Maximum awareness of process situations

Fully compliant with ASM (Abnormal Situations management) philosophy. Context based operations support (e.g. what went wrong / what is about to change). Automatic generation of relationship visualization derived from parametrized control code (fully consistency of program and HMI)

Control building blocks

Outstanding process control solutions

Powerful building blocks with one simple connection, by which 90% of mining & cement functionality can be just parametrized out of the box. Commands (e.g. interlocks, groups starts) as well as information (e.g. object status / control modes) are exchanged through the same connection and provide e.g. built-in alarm suppression.

Engineering / Maintenance

Bulk data engineering, lifecycle and evolution

Automated / efficient & quality mass generation of applications through CAE tools tightly integrated in the plant engineering workflow. HMI indications (such as interlock lists / group lists / dynamic navigation from PID loops to valves) are derived from the application & created at zero engineering efforts, ensuring full consistency of the HMI layer

Integration

Powerful interfaces to other specialized products

Tightly embedded within the holisitic solution portfolio such as Knowledge Manager (PIMS), Expert Optimizer (APC), Electrical Integration. The solutions provide plug & play interfaces, ensuring a seamless integration of data as well operation experience

Figure 6 - MinLib Building Blocks

1.1.1. Operation and Visualization

For a maximum awareness of process situations, the MinLib operation consist of the AC800M Minerals GraphiXs Library, which provides display elements and Faceplates for monitoring and control of objects, defined by means of the AC800M Minerals Library. Also, the MinLib includes an AC400 Minerals Library, which provides display elements and Faceplates for monitoring and control of objects of the AC450 controller family.

Operation effective user interface

The modules come with predefined and graphical aspects to build a powerful HMI for the operators. All objects have dynamic and bi-directional links between "Parent" and "Child" Faceplates. Additionally, the viewers implement a direct navigation to the objects.

Advanced Alarm handling

Built in alarm management

Automatic reduction of alarm severity depending on Display context and redundant coding of alarm information (shape and color)

Customization

Through the flexibility of the Minerals Library the process control and process indication can adapt to client specific requirements. Engineers can choose from pre-defined color and shape settings, structured into seven themes.

1.1.2. Control building blocks

For outstanding process control solutions the MinLib delivers several AC800M and AC450 Minerals Control Libraries, which contain the software modules that are used to configure applications using the AC800M or AC400 controllers.

Standardization of Control Modules

The library provides standardized control modules and function blocks to define the control application by parameterization rather than programming. The provided functionalities for process control are proven and well documented.

Bus System

The object-oriented control modules are connected with one single connection (control bus) to create interlocks, groups (starting/stopping) and control loops. Offering a graphical way of application programming, that is generally understandable.
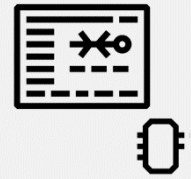
1.1.3. Engineering and Maintenance

Bulk data engineering, lifecycle and control system evolution

BulkData Engineering

By means of modular application programming the Minerals Library enables BulkData engineering tools (EBase from Aucotec) to efficiently engineer and manage very large control projects.

Testing, simulation and commissioning

The software blocks come with a built-in simulation mode for testing and operator training. They also incorporate a commissioning check framework to reduce commissioning time and track progress on site.

Life Cycle

Since 2000 the MinLib maintains a continuous library development with focus on project expansions and system upgrades.

1.1.4. Integration

MinLib provides a framework to rapidly integrate various sub-systems and electrical devices to the control system. It assures a continues flow of information from the device in the field to the HMI of the operator and simplifies maintenance. Part of this integration are powerful interfaces to other specialized products.

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1.2.   800xA System Extension Structure

The Minerals Library is imported into the system as extensions and comprises of multiple system extensions to cover the different installation options. The following figure shows the complete structure of all available system extensions:

Figure 7 - MinLib software structure

1.3. Source of information & related documents

The figure below shows the structure of the complete Library documentation (in the table on the bottom) and on the top the typical project documentation that is related to the Minerals Library.

00	**Product Guide**		11	AB PLC 5 IO Interface Objects
01	Overview, GettingStarted, Configuration		12	Process Panel *
02	Basic Objects		13	EnergyMgmt *
03	Loop Objects		14	Wrapper Objects
04	Consumer Objects		15	MNSiS MBTCP
05	Group Objects		16	GraphiXs User Guide *
06	Dosing Objects		17	UMC100
07	Communication Objects		18	ACS8x0
08	Power Distribution Monitoring Objects *		19	LCBType
09	Report Objects		20	Yard and Port Objects
10	Basic S400 Board & Objects *		21	OPC Interface Definition
EX01	800xA Minerals Library Knowledge Manager Integration (6.0/0 & 5.1/4)		22	Minerals Library Commissioning Check Framework
			30	VCO GraphiXs User Guide
			31	MinLib Hardware Viewer
			90	MinLib Installation Guide
			91	MinLib Settings

Figure 8 - Document Organization

*) these libraries are not further developed

1.4. MinLib SharePoint

The Minerals Library SharePoint is a website accessible for all ABB employees and provides an extensive source of information, such as manuals, video tutorials, presentation templates and download of the newest MinLib software packages.

https://abb.sharepoint.com/sites/MineralsLibrary/SitePages/Home.aspx

Figure 9 - Screenshot of the MinLib SharePoint entry page

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2.   Minerals Library Operation and Visualization

2.1.   Minerals Library operation concept

The mission of the minerals library together with the System 800xA is to master the following 3 system loops. The MinLib solution takes care about the human factor and make each of the three loops as efficient as possible. It is all about providing visibility to the operator and present data in an intuitive manner that humans do understand correctly and can take the right decisions at the right time.

Control Loop

Collect valuable information and integrate subsystems from ABB or any other vendor efficiently and consistently into 800xA.

Operation Loop

Bring relevant data and information to the right person at the right time and therefore increase the operator's ability to supervise and control processes in the most efficient, safe and profitable way.

Maintenance Loop

Provide capable interface to asset management tools and personnel.

Figure *10* - Mastering the three loops in making the best out of assets and the human competences

2.1.1.   Consistent operation concept Point Of Control (POC)

The Group Objects are providing access and control for a process group and consumer objects that provide access and control for the physical devices (equipment) in the plant. The Group and Consumer shortly mentioned in section 1 and for more detail information about the Group Object, refer to the user manual "3BHS161561". MinLib Objects have the 4 following Points of Control :

Operation on Faceplate	Point Of Control
	POC: SEQuence
	POC: CENtral
	POC: LOCal
	POC: Out Of Service

All POC are selectable from the Operator station. The point of control defines from where the object will be controlled. In order to control an object, the corresponding POC must be selected before giving any command to the object. For safety reasons, stopping an object or closing a gate is always permitted, no matter which control mode has been chosen.

Sequence: The object is controlled by a superior application program, e.g. from a drive group sequence. Sequence mode can be set from the operator station or by the application program.

Central: The object is controlled by the operator station by means of the start/stop or open/close push buttons on the Faceplate. Start/stop or open/close from a superior application program is also possible in this mode. The Central mode can be set from the Operator Workplace only.

Consumer Objects in POC Sequence and Central have two sub-modes:

	Manual Mode
	Auto Mode

Man (default): An object is controlled by a rising edge start / stop command, either released from the operator station or from the superior application program.

Auto: An object is controlled by a control application input IA (IA =1 starts the motor, IA=0 stops the motor). Typical use of the auto mode is on/off control by thermostats, level switches, etc.

In Central Auto and Sequence Auto mode the operator cannot control the object any more from the operator station. Stopping a motor and closing a gate is always possible.

Local: The object is controlled from the field via the pushbuttons on the local control box (LCB). To operate a drive locally, the drives need the local release from the CCR operator. The point of control has to be changed in the CCR and can be set for a complete drive group or for every object individually.

The interlocks are **de-activated** in this mode except for the safety interlock IC (Rope Switches, Bearing/Winding Temp., Vibrations etc.). Furthermore, the two feedback signals (FB1 and FB2 – for example speed switch) are also de-activated while pressing and holding the start/open push button. Typically, the Local mode is used for maintenance purposes.

– Note: Alarms are disabled when an object is in Local mode (no alarm acknowledgment on the operator station necessary when the object is operated from the field).

– **Out of Service:** The object is not in service and cannot be started from any location. It also means that the object will be skipped when running a superior group sequence. Out of Service mode can be set and reset from the operator station with special user rights only.

2.2. Process display indication of AC800M Minerals Library

The operation library integrates the Control AC800M Minerals Library with the Process displays. The AC800M Connect Minerals Library provides display elements and Faceplates on the process displays, for monitoring and control of objects defined by means of the AC800M Minerals Library.

	Consumer Objects					
	Motor	Fan	Pump	Valve	Damper	Diverter
Off / Ready for Start						
Starting/Stopping						
Running						
Running (Dir X)						
Position X / Open	n/a	n/a	n/a			
Running (Dir Y)						
Position Y / Close	n/a	n/a	n/a			
Intermediate Position	n/a	n/a	n/a			
Object Fault / Alarm						
Run with Warning (High Current)						
Object Interlock – Not Ready for Start						
Warning Interlock (PCC) – Not Ready for Start						

Figure 11 - Examples of the display elements with status indication of equipment as presented on the process displays.

2.2.1. Minerals Library Faceplate

The following illustration shows a Faceplate of a motor block. Mentioned are the most important operator's use cases and the interested reader shall refer to the chapter "VCO Faceplates" in the manual 3BHF004109.

❶Object Tag name description

❷Point of Control Indication

❸Object status Indication

❹Start motor ❹ Stop motor

❺Change Point of Control

> Seq => Sequence
> Cen => Central
> Loc => Local

❻ Call up Object Alarm List,

❻ Call up Object Event List,

❼Acknowledge Alarm

❽FP Normal View

2.3.   Minerals Library Visual Control (VCO)

Introduced with the 800xA version 6.1 the Minerals Library VisualControl graphics is a completely new approach on process control HMI and through the advanced functionalities it is reinventing process control HMIs. Also, VCO is the first of its kind to display information in situational context. Based on significant technical advancement on the 800xA 6.1 platform, all Minerals Library graphic elements have been rebuilt emerging with a unique and consistent design philosophy.

The MinLib graphic elements have been completely rebuilt and are entirely based on the "EffectItems" introduced with the System 800xA 6.0.

The new design led to a simpler, grayer, almost minimalistic look designed to remove all possible distraction for operators (ASM). However, the VCO graphics seek to balance the other 2 remaining forces of the traditional BMI GraphiXs standard and the situation awareness presentation of process information.

Maximize information handling

The visual control graphic elements are designed to provide operators a holistic view of the process with a high situational awareness for any given situation in the plant. This enables them to make good decisions based on intuitive and understandable process visualizations. By its nature it is very hard to balance the forces illustrated by the previous image and satisfy all requirements on the process graphics on the same time. The solution of VCO is using a simple mechanism to change the Display mode and optimize the process presentation on the selected DisplayMode. Currently optimized presentation modes for "Start/stop", Production and abnormal situation management (ASM) are implemented.
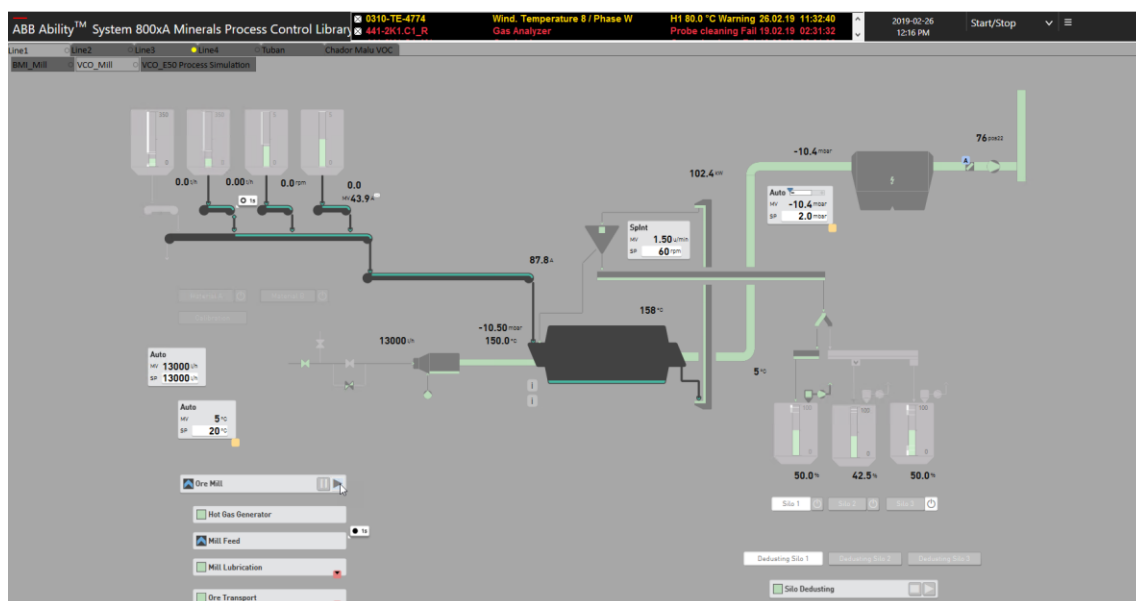
Figure *12* - Display Mode *Start/Stop*: Provides detail information related to starting or stopping a process section
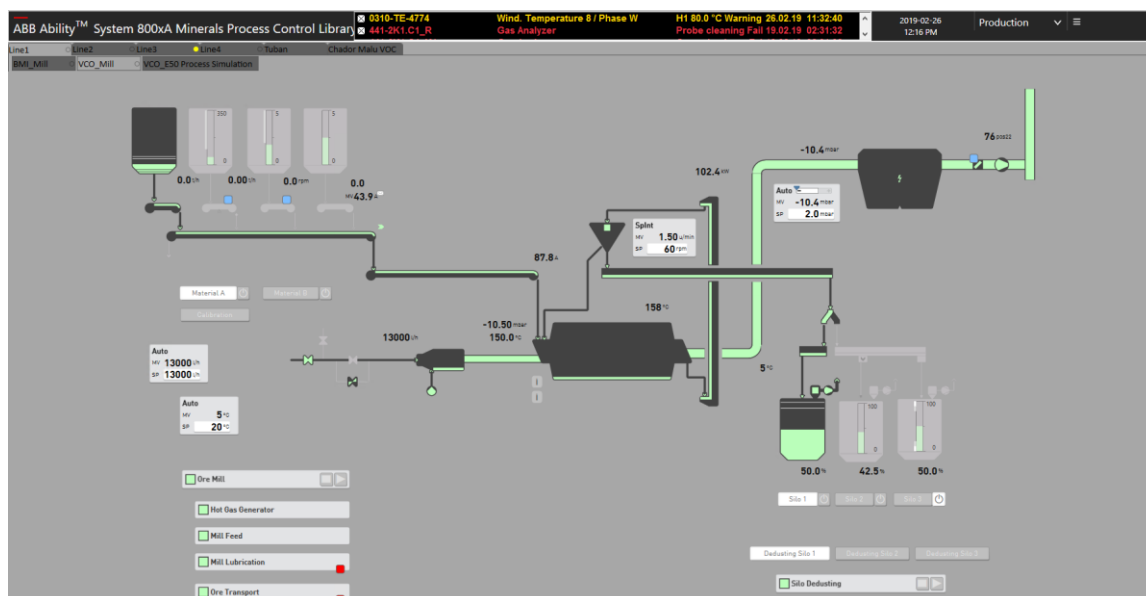

Figure *13* - Display Mode Production: Active equipment is emphasized by color *to highlight production and material flow*

Abnormal Situation Management (ASM)

The process graphics introduce a unique alarm indication that includes the functionality to immediately detect, understand and resolve any type of process disturbance. In order to draw the operator's attention to the situations that require it, VCO represents an Alarm (abnormal situation) directly on the object that is the most critical to the production process. The VCO alarming presentation includes a consistent and reserved use of alarm colors and redundant alarm information coding. Also, VCO does indicate alarm relations between objects to link different plant operational levels. By its nature VCO supports the previously available MinLib process state-based alarm suppression and the 800xA function of alarm shelving.

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Figure *14* - Display Mode: ASM, grey scale used for process state visualization and colors uniquely reserved for Alarms

2.4.   Look and feel adapted to your needs[1]

The library contains several possibilities to adapt its behavior both visually and functionally and those customization possibilities are described in the reference documentation (01 Minerals Library Overview).

1 currently there is only one predefined theme available for VCO. More will be provided in future releases

Minerals VisualControl Standard   *Holcim VCO Theme*

For the traditional graphics, not VCO, the following predefined styles are available with the standard installation package:

Minerals Standard   **ASM Standard**

VALE Standard   **Holcim Standard**

Figure 15 - Minerals Library Styles for the traditional MinLib GraphiXs (incomplete)

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In addition to the configuration possible for Object and Graphic Element, colors and some settings can be done via the Operator Workplace to re-use the same display graphics for different environments. Furthermore, Minerals Library comes with National Language Support (NLS) that allows to provide each user individually with descriptions, texts and alarm messages in his native language.

2.5. Installation

The MinLib can be installed (to be download on 1.4 MinLib SharePointon) the 800xA System using the System Installer. Please refer to the document "3BHF004108-MinLib LifeCylcePlan" for the 800xA / MinLib compatibility.

3. Control building blocks - AC800M Minerals Library

Control AC800M Minerals Library contains controller software modules that are used to configure applications with the main focus on a complete solution to control an entire plant in the minerals industry using the AC800M controllers. A set of purpose-built software modules has been developed and are supporting the process requirements for these applications. The software modules are developed with the ABB Control Builder M Professional programming tool, as **Control Module Types (CM).** The types of the exceptions of this rule are stated separately.

This current version runs on System 800xA Version 6.1, and supports applications programmed using the Control Builder M Diagram Editor (FD).

These software modules comprise the Minerals Library, and are grouped into eight different **object categories**:

– Basic Objects

– Communication Objects

– Consumer Objects

– Dosing Objects

– Group Objects (sequencing)

– Loop Objects

– Power Monitoring Objects

– Report Objects

– Energy Management

A separate Reference Manual is available for each object category providing more details as shown in Figure 8.

3.1. The alliance of the Control Connection (-CC)

Software Modules in the Minerals Library exchange data on predefined interfaces, so called control connections (data highway). The following illustration includes two (PCC and GCC) out of the three data connections. The CC are used in the application program to implement logical connections between various application objects. It uses structured variables and hence lowers the engineering time (requiring only one logical connection) while increasing the amount of information exchanged (multivariable connection) between application objects.
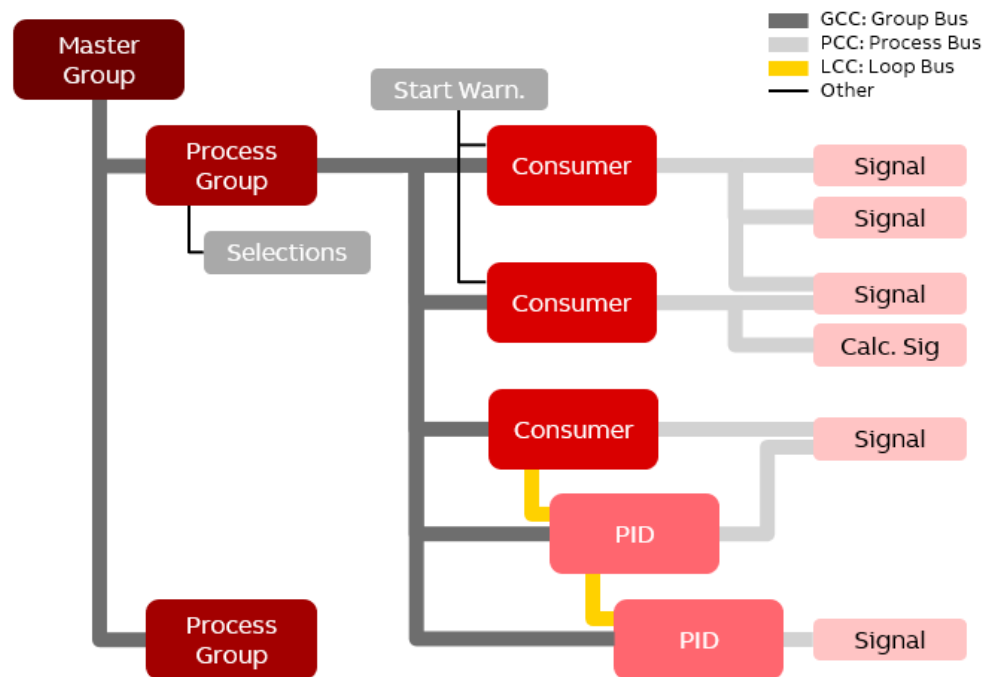
Figure 16 – Overview MinLib CC- connections

– The status from child objects are always reported to the parent object and vice versa

– Commands can be sent from parents to children and from children to parents.

– Unlimited number of connections between the objects. E.g. the PCC allows an infinite numbers of interlock(signals) acting/stopping a consumer.
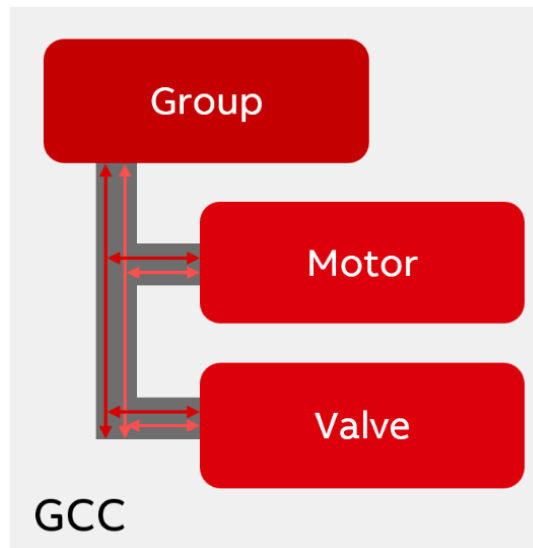
GCC: Group Control Connection

Connecting consumer objects to superior group object

– Executes the start and stop of consumers connected to the group in a given or dynamic start / stop order

– Summarizes to status of all connected consumers and indicates it on the group object

– Pre-Selection objects for parameterized routing and duty standby applications.

PCC: Process Control Connection

Connecting consumer objects, parameters are configured on the signal objects to define the interlock behavior to the consumer object.

– Connects consumer objects with their interlocking and process control signals

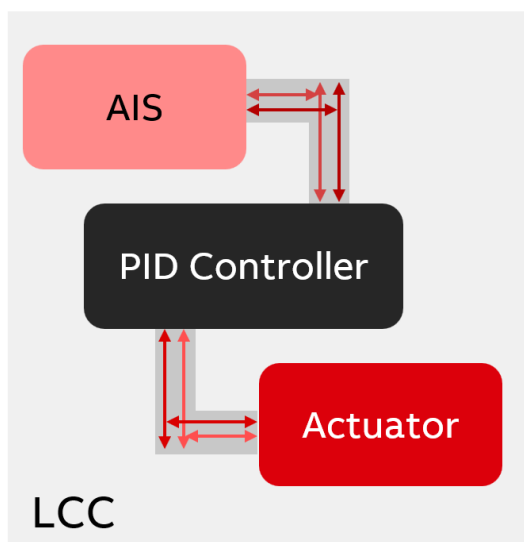– Parameters on the signal modules define the interlock between the signal and the consumer

LCC: Loop Control Connection – Analog loop control

Connecting Motor or Actuator to PID Loop Block

– Error Handling and Value Backtracking

– seamless information transfer on who is in control

3.1.1. Control Builder Connections

In traditional PLC (programmable logic controller) programming, connections must be drawn for every boolean signal. While this is quite versatile and can be engineered for any situation, it also has many drawbacks, among which are readability (different PLC programmers may have very different programming styles) and maintainability/extendibility. Adding new functionality can lead to a whole diagram changing, requiring a tedious and lengthy procedure.

Traditional PLC / controller programming　　　　　　　**Functional design with parametrized building blocks**

Figure 17 - Traditional PLC versus MinLib programming

To simplify the programmer's job and to provide some abstraction to a higher level, in the Minerals Library instead of programming single ports and connections, we use blocks (Control Modules) which encapsulate functions that are typically used in mining and cement industries. These blocks cover about 90% of the use cases in those industries and even though they may contain unused functions in particular instances, the memory and performance overhead are negligible considering today's computing power. By parameterizing the input properties, an engineer can now easily choose the functionality they need.

Control Modules are connected to signals via the Process Control Connection (PCC) (see Figure 19). They can also be connected to a group via the Group Control Connection (GCC) and given group start steps which define the order in which the objects in a group are started. The control connections use structured variables to encapsulate information. These **bus connections** are automatically visible to the operator in the PCC Viewer and the Group Step

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Viewer. However, the glue logic added for special functionalities that is not covered by the standard MinLib blocks , is hidden to the operator.

The illustrations below show the relevant variable connections and parameter settings for GCC and PCC connections.
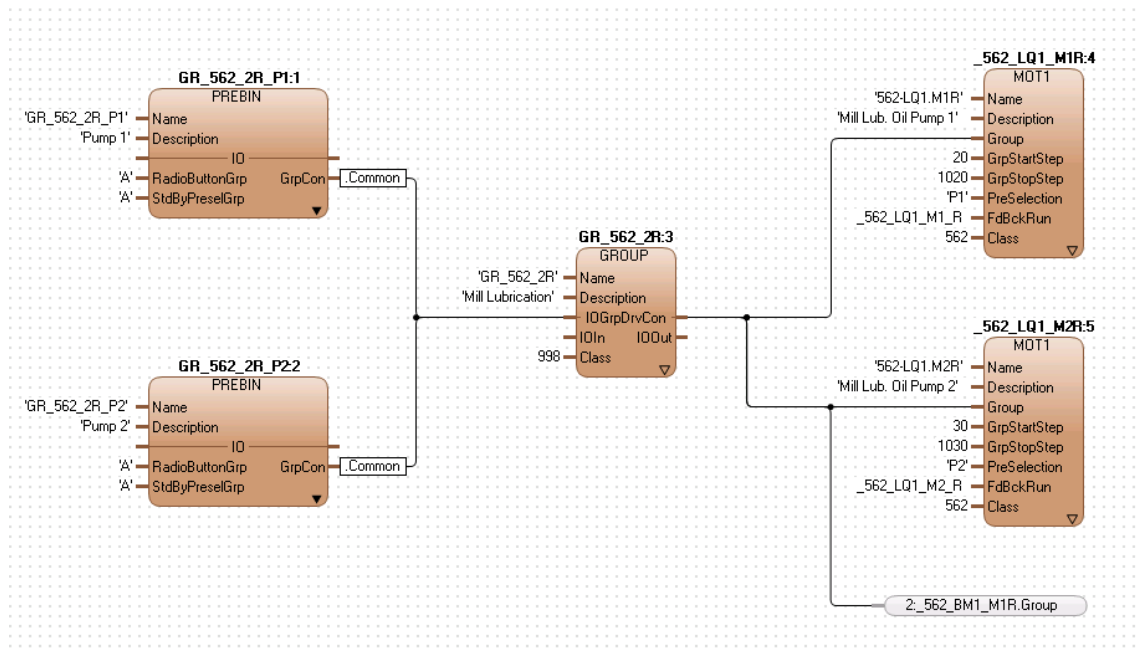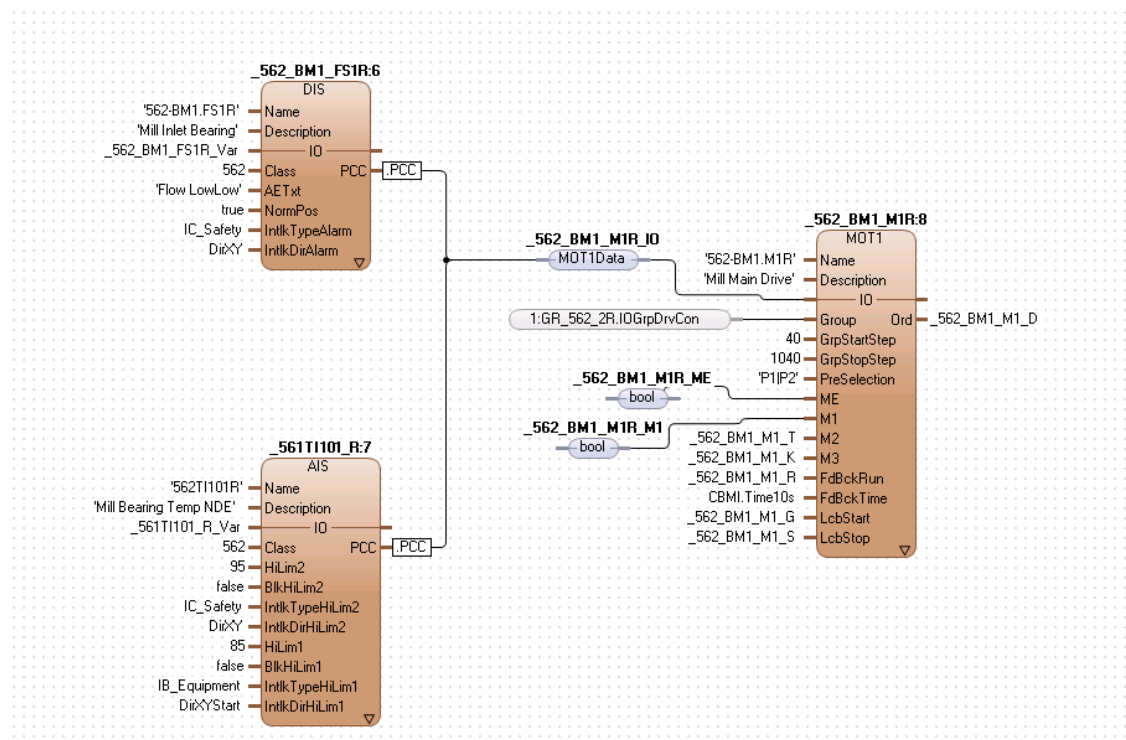

Figure 18 - Flow and Connection for GCC

Figure 19 - Flow and Connection for PCC

3.2. Process Control Connection (PCC)

The following very basic example of PCC and GCC shows the logical structure of a Minerals Library Application Program. It illustrates the seamless information transfer over the PCC Bus on a specific example that shows the signal (DIS, DIC, AIS and AIC) condition that is causing some fault in the consumer object on the Group and Motor Faceplates. The tag name of the alarming input signal is shown on the Faceplate of the consumer. In the same way you will find the link from the DIS, DIC, AIS and AIC Faceplate to the consumer tag name. Alarms can be acknowledged at any Faceplate, i.e. the acknowledgement given on the group level will be propagated through the motor down to the signal level.

3.2.1. Basic situation of signals connected to a consumer by PCC

Example to illustrate the simplicity and benefits of the PCC

The program code in the CBM diagram editor with the Minerals Library elements is shown on the left and on the right the corresponding graphical elements on the HMI, as they are presented to the operators.

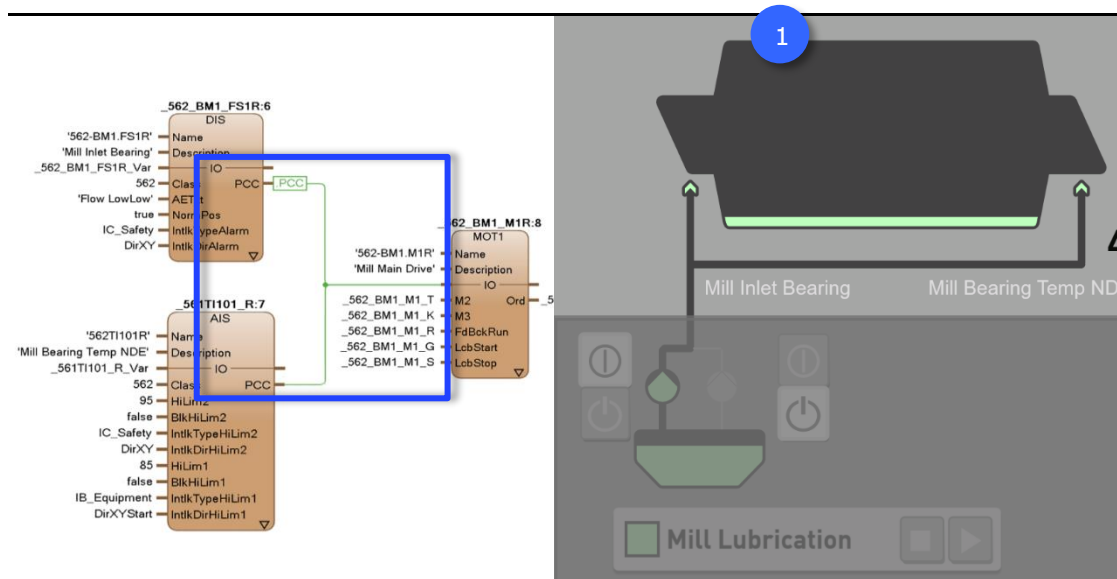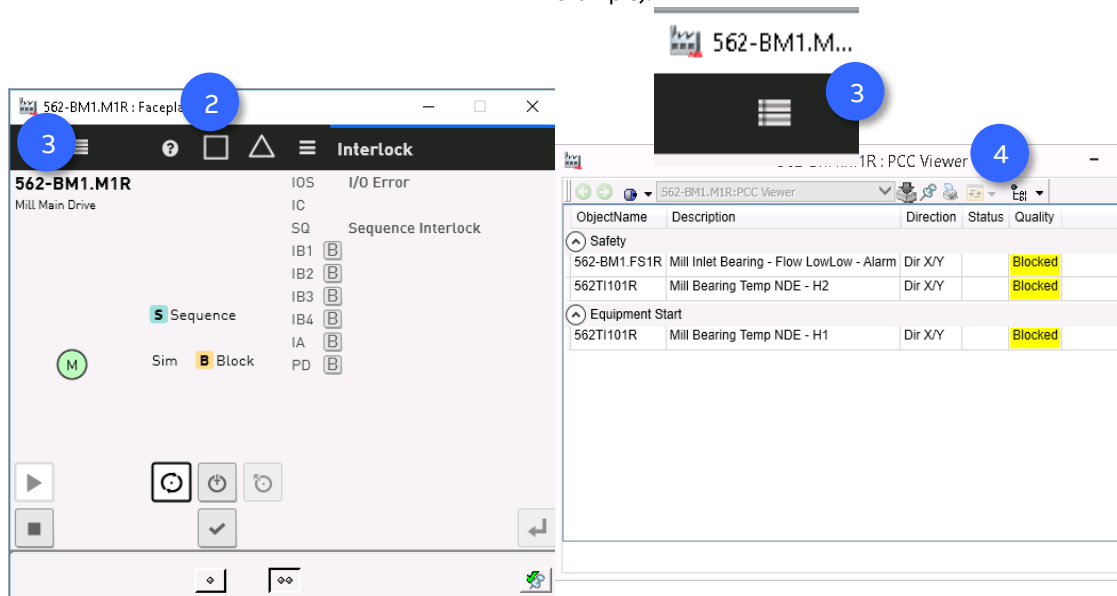|	
Minerals Library object: DIS ❶ Control Module: _562_BM1_FS1R Module Parameter "Name": 562-BM1.FS1R	The axial plain bearings of the mill are supplied with oil. The unit is equipped with a flow switch 562-BM1.FS1R ❶ that detects the flow of the supplied oil. The signal is in a heathy state and therefore hidden and only shown on demand with a grey background.
Minerals Library object: MOT ❷ Control Module: _562_BM1_M1R Module Parameter "Name": 562-BM1.M1R	The grinding process is actuated by the mill main drive ❷ that is shown in its running state on the HMI.
Minerals Library object: AIS ❸ Control Module: _561T101_R Module Parameter "Name": 562TI101R	The mill bearing temperature ❸ is monitored by an analog signal located at the bearings. The analog signal is shown as a digital number in its normal state to the operator.

Minerals Library PCC viewer of a standard consumer MOT1

The standard motor module of the Minerals Library is highlighted on the process HMI, in the code we would like to draw the reader's attention to the PCC bus that interconnects the control module of the motor and the analog and digital signal presented in the page before.
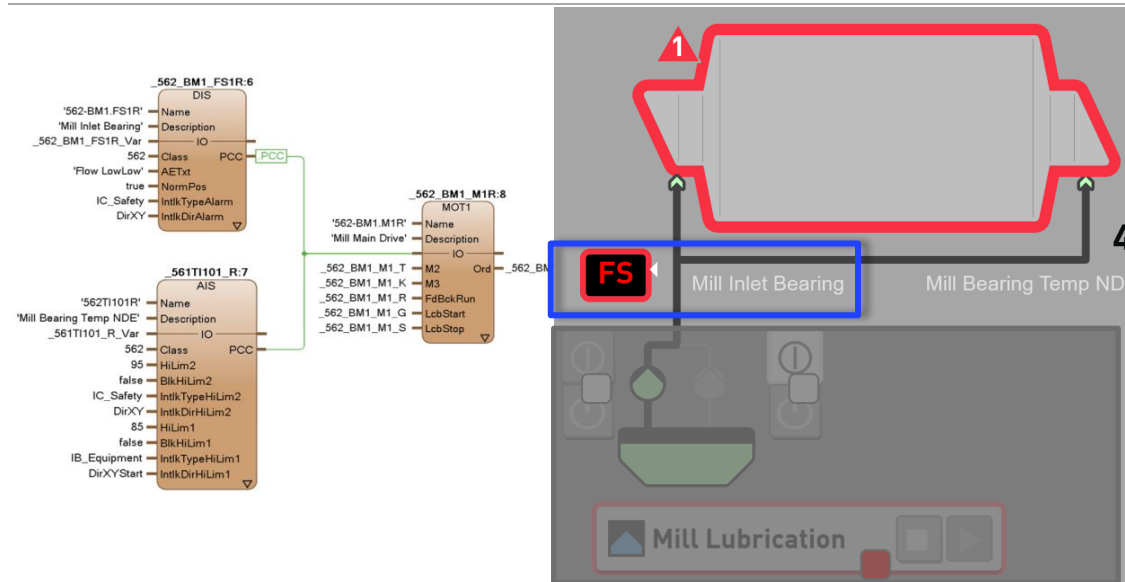

By clicking on the motor ❶ on the HMI the Faceplate of the motor ❷ opens.

The PCC Viewer ❹ is located in the Faceplate. A click on this icon ❸ brings up the window shown below. The PCC viewer is a basically a table that provides a complete and consistent overview of the interlocks acting on a specific consumer (Mill Main Drive in this example).

Alarm forwarding through PCC between IO signal and the control object

In the following illustrated situation, the mill motor was stopped due to an unhealthy flow switch signal. The motor does not show a running status anymore (status: off) and an alarm indication is present on the digital signal and on the motor itself. A consistent exchange of information between the assets is provided over the PCC.

Additional details about the motor stop are revealed by opening the Faceplate of the motor. The reason for the trip signal is written in text highlighted with a blue frame in the faceplate below.

The PCC viewer of the motor also indicates the actual reason for tripping the motor with a highlighted red line. 1 Active safety interlock.

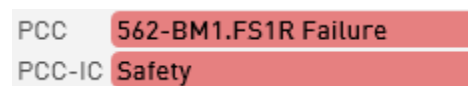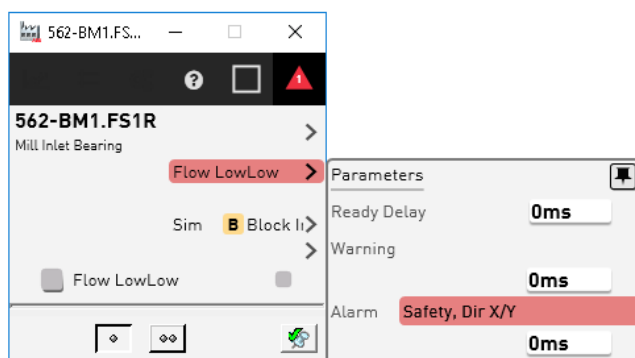**Drill down navigation through Faceplate link**

Starting from the motor that was stopped by the interlock ❶, the Faceplate of the motor ❷ is opened from the process HMI.

As mentioned before, the reason for tripping ❹ is indicated on the Faceplate, also in the **PCC Interlock** popup the IC interlock is active.

By clicking on the highlighted text ❸, the Faceplate of the flow switch is opened for an in-depth analyzation of the root cause.

In the **PCC** tab of the signal Faceplate the PCC alarm configuration is shown as IC Safety valid for both directions X/Y.
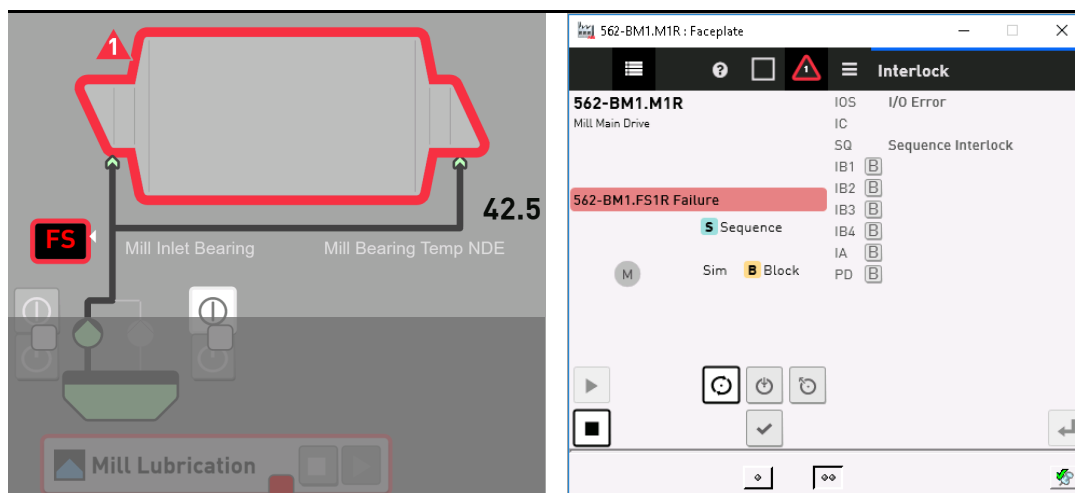
Drill down through PCC viewer

Like in the illustrations above, the navigator opens Faceplate of the motor. This time the navigation to the signal (root cause for motor stop) is done through the PCC viewer as an alternative option.

The PCC viewer is opened by clicking on the corresponding icon in the motor Faceplate.

Clicking on the highlighted bar ❶ in the PCC will open the Faceplate of the flow switch.

3.3. Group Sequence Control (GCC)

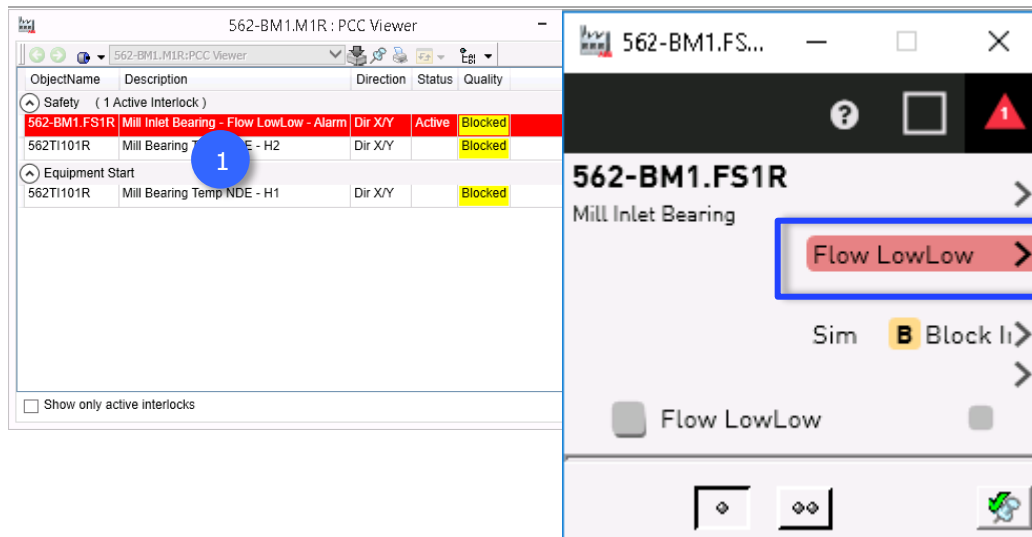For Group Control the Minerals Library applications provide state of the art functionality for sequence start, stop, route and monitoring of all process objects in the plant.

Group status indications and monitoring

The figure below shows all possible status indications of the group as presented on the process display.

Off	Mill Feed
Starting with Startwarning	Mill Feed
Running	Mill Feed
Running restart required as pre-selection has changed	Mill Feed
Stopping	Mill Feed
Running, warning in some of the connected equipment	Mill Feed
on Hold (not off but also not fully running) Failure, not ready for start	Mill Feed
on Hold	Mill Feed
Off Start interlock	Mill Feed
Running Stop interlock	Mill Feed
Off Active alarm on the group or because of Failure in at least one of the connected consumers	Mill Feed
Not ready for start because of an active interlock in at least one of the connected consumers	Mill Feed

The group constantly monitors all process objects assigned to it and updates the status in real time. The Faceplate provides additional detailed indication on:

– Tag Name of the object not ready for start or in hold

– Interlock text for group start and stop interlocks

– Actual step and tag during start-up and stopping

– Indication of missing pre-selection or error

Group not Ready for Start	Group Starting	Group in Hold
GR_562_2R not RFS	GR_562_2R starting	Second Object in hold:
(not Ready for Start)		GR_562_2R

Figure 20 - Example of Group Faceplate indicating

Starting a group

A group may be started, if all pre-selected equipment assigned to the group is ready for start, the pre-selection is set correctly, and no group start interlock is active. Initial starting is possible from status "Off / Ready for Start". A group restart can be performed from the status "Stopping", "Hold" or "Running".

Before starting the group, the pre-selections such as selecting alternative routing, standby units, set points, etc., may be adjusted. The new settings are indicated in the process display and the Faceplate.

After pressing the "start" button in the Faceplate the following steps are executed:

– An audible start-up warning is activated for all related equipment, optionally the start warning can be configured to be executed prior to the start of individual equipment. The group indicates "Starting / PreWarning"

– After a certain adjustable time, the startup warning stops, and the equipment starts running, respectively moving into the position according to the programmed sequence and used pre-selections. The group indicates "Starting" and the step number and tag name of the currently starting equipment can be monitored on the Faceplate.

– A successful start-up is indicated by the group status indication changing to "Running". In case any important equipment fails during the start-up, the group indicates "Hold" resp. "Drive(s) not Ready for Start".

Unconditional Start (available in extended Faceplate)

Additionally, a group can be started by an unconditional start, even with equipment not ready for start. That means that the group will start up to the start step of the equipment which is not ready for start. This function is not active in case of a group start interlock.

Stopping a group

A group may be stopped in case no stop interlock is active (e.g. group can't be stopped because another group is still not off). Stopping is possible from any status, even the group "Starting" status.

Pressing the "Stop" button changes the indication to stop and all equipment will be sequentially stopped or moved to the defined "off" position, leaving the equipment in a suitable condition for the next start-up – transport systems emptied of material, dampers turned to safety position. After a successful stop the group indicates "Off / Ready for Start".

Instant Stop / Quick Stop

A stop may be performed instantly, disregarding the programmed appropriate stop order by pressing the "quick stop" button in the Faceplate. The "instant stop" stops all equipment in the group simultaneously. For actuators and loop controllers the specific action to be executed at a quick stop can be adjusted individually. The instant stop can be activated at any time (even if a stop interlock is active). In such a case the other drives and/or groups are stopped according to the process interlocks.

If an alarm condition arises during the group start sequence (e.g. fault or process interlock of equipment starting or already running), the start-up will be interrupted automatically and the group indicates "Hold / Drive(s) not Ready". The object name of the equipment causing the fault is presented in the group Faceplate and the operator can directly link to the equipment Faceplate to get more detailed information.

"Hold" means that only a part of the group is in operation (not completely started or stopped). At this state by pressing the "stop" button, the rest of the group is stopped in accordance with the stop sequence or if the fault can be removed, the start sequence may be reactivated by selecting the group and pressing the "start" button again.

A group may be started if all pre-selected equipment assigned to the group is ready for start, the pre-selection is set correctly, and no group start interlock is active. Initial starting is possible from status "Off / Ready for Start". A group restart can be performed from the status: "Stopping", "Hold" or "Running". Additionally, a group can be started by an unconditional start, even with equipment not ready for start, meaning the group will start until the start step of the equipment which is not ready for start.

Before starting the group, the pre-selections such as selecting alternative routing, standby units, set points, etc., may be adjusted. The new settings are indicated in the process display and the Faceplate.

Manual Hold

The operator may manually interrupt the starting, stopping or quick stop procedure of a group at any time by pressing the "hold" button on the Faceplate. In this case the group will indicate hold until the starting or stopping process is continued.

Pre-selections

The pre-selection function allows motors to be included in the start-up process of a group. By setting and resetting the pre-selections, the operator may define which objects should be activated or deactivated by the next start command. Even an on-the-fly change of the pre-selection (e.g. automatic change of silo filling) may be programmed. This is a fully automatic change of the pre-selection during the group running status.

By clicking with the left mouse button on the pre-selection button, the pre-selection will be set/reset. The status of the pre-selection is shown on the button. At the group start any changes of the pre-selections will be considered and the new configuration of the pre-selections is activated.

The figure below shows the possible status of a preselection.

Off /not selected	Dedusting Silo 1
Selected to Start	Dedusting Silo 1
Selected and Started / Running	Dedusting Silo 1

Selected to Stop	Dedusting Silo 1
Off / not Ready for Start	Dedusting Silo 1 ✕

The operator is allowed to change the pre-selections when a group has one of the following status:

– Group is stopped completely

– Group is running (on-the-fly change)

– Group is in HOLD mode

– Pre-selection change is not interlocked by the process (dimmed indication)

During a start-up or a stop of the group, a pre-selection change is prohibited.

If only one pre-selection setting at a time is allowed to be active, the other pre-selections are deactivated automatically (radio button function). If more pre-selection settings are possible at the same time, the operator can manually choose the configuration.
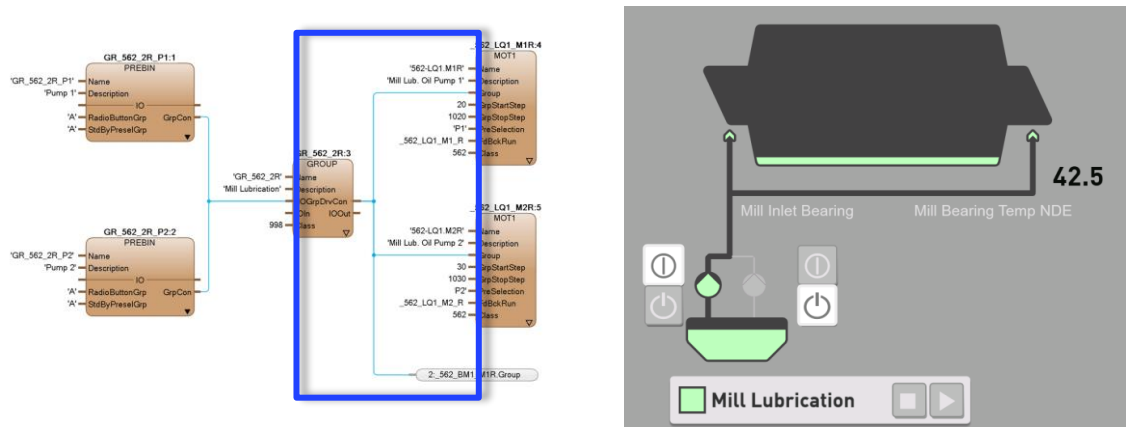
Missing and wrong pre-selection combinations prevent a group start. In that case there is an indication on the group Faceplate.

Basic situation of a group containing 3 consumers

Example to illustrate the simplicity and benefits of the GCC (Group Control Connection)

The program code in the CBM diagram editor with the Minerals Library elements is shown on the left and on the right the corresponding graphical elements on the HMI, as they are presented to the operators. J

Minerals Library object: **GROUP**
Control Module: GR_562_2R
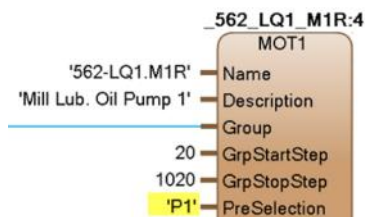Module Parameter "Name": GR_562_2R

In this process the group contains three consumers, which are the two pumps 1 & 2 and the mill main motor. The mill motor has already been used and explained in the PCC example. These three consumers are connected by the GCC, highlighted with blue color in the picture showing the code. The GCC to the mill motor is connected with a grey link connector.

Minerals Library object: **PREBIN**
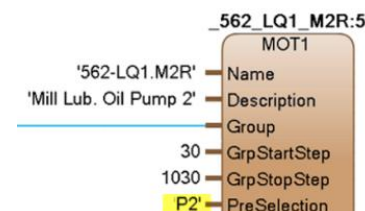Control Module: GR_562_2R_P1
Module Parameter "Name": GR_562_2R_P1

The axial plain bearings of the mil are supplied with oil. The oil pressure is produced by two redundant pumps. There are only one out of the two pumps running at any given moment.

Minerals Library object: **PREBIN**
Control Module: GR_562_2R_P2
Module Parameter "Name": GR_562_2R_P2

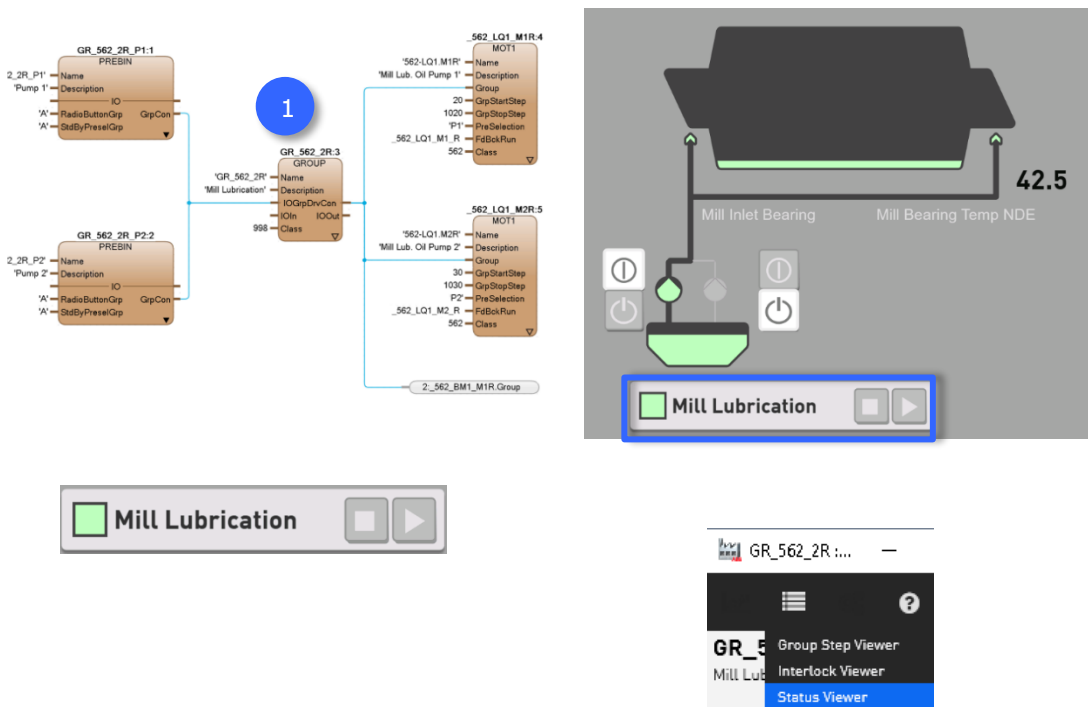The pump that is not running is selected as standby. This means that the second pump will be started in case the first one fails.
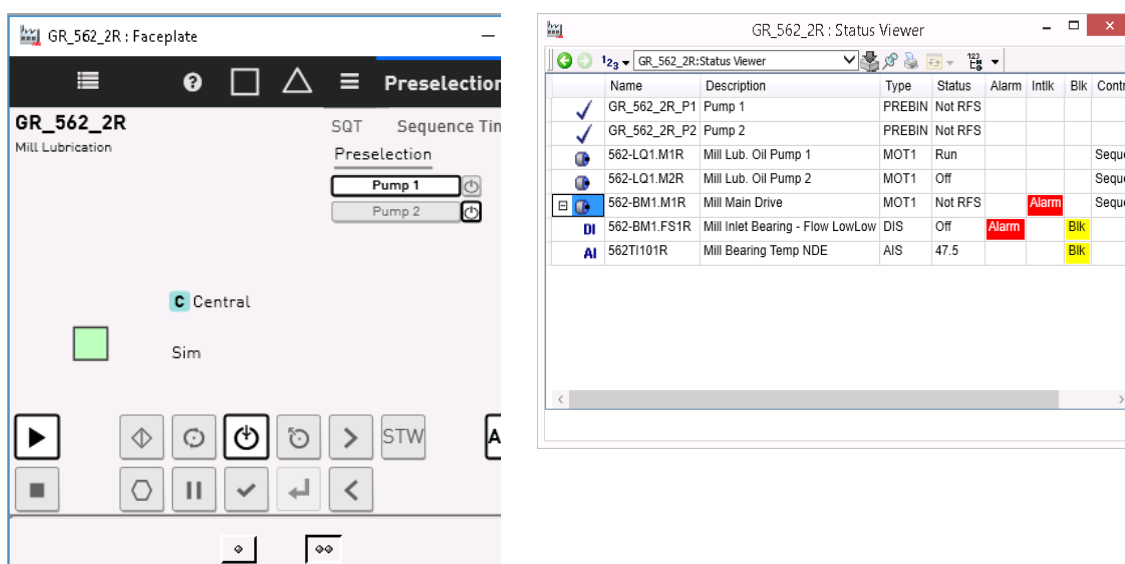
Mineral Library standard group module

The standard group module of the Minerals Library is highlighted on the process HMI with a blue frame. The functionalities presented on the following pages are all provided by the GCC highlighted with blue lines in the code ❶.
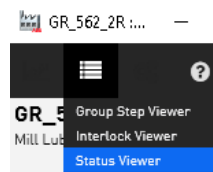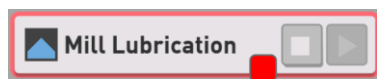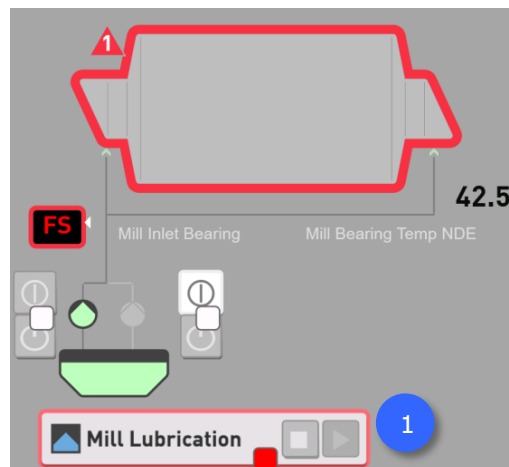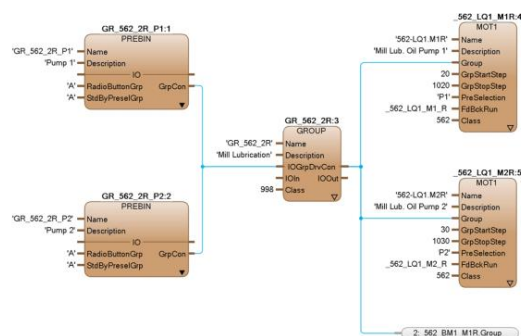

By clicking on the group icon on the process HMI the Faceplate of the group opens.

In the Faceplate the link to the group status viewer is located. A click on the button brings up the window shown below.

Forwarding of Warnings and Alarms through GCC and PCC

In the following illustrated situation, the mill motor was stopped by an unhealthy flow switch signal. Exactly the same situation was illustrated in the PCC example, but this time the starting point of troubleshooting is the group ❶ and not the motor.

Additional information about the group stop is revealed by opening the Faceplate of the group. The first consumer not running is written in text.

The group status viewer of the group also indicates the actual status of the group

Additionally, the status viewer contains information about the signal connected through the consumer.

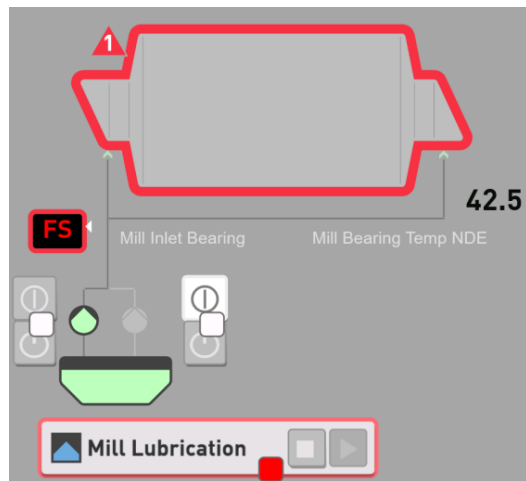**Drill down navigation from group to consumer to signal**
Starting from the group that does not show running anymore, the Faceplate of the group is opened from the process HMI.

As mentioned before the reason why the group is not running anymore is indicated on the Faceplate.

By clicking on the highlighted text, the Faceplate of the consumer is opened.
As explained in the PCC example the reason for tripping is indicated on the Faceplate of the motor

By clicking on the on the highlighted text, in the Faceplate of the motor again, the Faceplate of the flow switch is opened (root cause).

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3.5. Loop Control Connection

With the loop control connection (LCC) the Minerals Library applies the bus concept to the world of loop control. The consistent linking between objects enables engineers to design complex control concepts with a standardized structured approach. A structured Datatype **LoopControlData** is available with all Loop Objects and several Consumer Objects, for building analog control loops with one single connection between blocks.

Together with forwarding the setpoint from the controller to the actuator object, navigation between the blocks connected by LoopControlConnection is available to the operator in the Faceplate, and any alarm state of the actuator with corresponding color is shown for the related output value in the controller Faceplate as well.

Backtracking is an important feature of the LoopControlConnection concept. A setpoint consumer always transmits the actually used value in reverse direction so that the producer can adjust for the situation, to enable bump less transfer between the modes and anti-windup function in PID Control Loops.

The LoopControlConnection inherits the features of the ControlConnection available within the Standard AC800M Control Libraries. For a detailed description of the ControlConnection Datatype, please refer to the "AC800M Binary and Analog Handling" Manual (3BSE035981).

3.5.1. Cascade Loop control with LCC

The following example shows a common control situation, where a temperature is controlled by two cascade PIDs.

Figure 21 - Control Builder code of cascade loop

❶ Consumer valves (1+2), ❷ inner PID, ❸ outer PID

Value propagates from ❶ to ❷ to ❸

❶ to ❷: Measuered value of 20000 l/h propagates

❸ to ❹: Valve position value of 80% propagates

(reverse direction): blocking propagates to controller Faceplate

❹ Master PID Faceplate, ❺ Slave PID Faceplate, ❻ Consumer Faceplate

The setpoint set in the master PID has effect in direction ❺ to ❻

Figure 22 - PID Control Flow

STATUS	SECURITY LEVEL	DOCUMENT ID.	REV.	LANG.	PAGE
Approved	Public	3BHS161554-613	F	en	45/68

4.   Engineering and Maintenance

The Library offers value adding functionalities to all project phases (engineering, testing, commissioning, project expansion and control system upgrades).

4.1.   Bulk data engineering

The standardized and modular approach (Chapter 3.1.1) provides an excellent foundation for bulk data engineering. Given that MinLib can count some of the world's biggest mining companies (whose plants contain several tens of thousands of motors and signals) among its long-lasting customers, an efficient way of storing and visualizing this data is required. This is done with Aucotec's Engineering Base (EBase), which besides being a database, provides further functionality with a version control system to track changes that were made, and compiles Microsoft Visio drawings of electrical and instrumentation components. Other possible workflows exist, e.g. using Excel, but having a database with the above-mentioned properties is extremely useful, especially in large projects.

4.1.1.   Details of the EBase to 800xA interface

In large projects the base engineering is performed in EBase, as stated before. The MinLIb interface with EBase is based on macros added into EBase, at first to import customer consumer and signal lists and then to export the relation between the consumer and signals, defined in EBase, to 800xA control application. The direction goes both ways and the application can also be uploaded back to EBase ❷ so that any changes to hardware or software are tracked. This workflow ensures consistency because there is only one source of data.

Figure 23 - Simplified interface to EBase, ❶ application export, ❷ upload to EBase

5. Minerals Library Integration

5.1. Commissioning Check framework (CCF)

This framework is included by default in the Minerals Library product and allows users to periodically create reports that graphically illustrate the progress of signal checks during the commissioning phase of an automation project.

The framework empowers engineers and operators to capture the results of the signal tests in real time on the Faceplate. All Minerals Library objects are including a commissioning tab in their Faceplate that is visible only during commissioning.

Advantage

– Reliable, fast and easy method to capture the commissioning status while performing the signal checks in the field

– Centralized data handling and simultaneous multi-user editing

– Traceable and quality control (including time stamp and user information)

– Specific test cases per control objects

– Adjustable to project specific test cases

Figure 24 - CCF Tab of MinLib Obj FP

The asset specific test cases are defined with EBase and automatically generated in 800xA. The data is consolidated in the EBase data base and the commissioning progress over time is made visible for the entire plant startup time.

The provided functionality allows users to simply export the results to Excel and generate predefined graphical progress reports. It is up to the user to present absolute or relative measures that are applied to a unique process section or over the entire production plant. The provided dashboards are flexible and adjustable to address specific project needs. Failed test cases are linked to assets in the field and are available for further automation and electrical planning.

Figure 25 - KPI Graph of CCF

5.2.   MinLib Knowledge Manager integration

This extension offers an interaction with the information Management solution of ABB called Knowledge Manager (KM). This product connects process control systems to a collaborative production management (CPM) system, that empowers continuous improvements by converting data into actionable information. With the KM extension of the Minerals Library a Knowledge Manager aspect is added to the MinLib objects. This aspect embeds a Web browser window to gain direct access to the long-time trends and a vast variety of reports provided by KM.

Advantage:

– Direct navigation from the 800xA operator process displays to the KM reports

– Call up the historian trends from the MinLib objects

– The structure in 800xA is automatically build in Knowledge Manager. Assuring consistency and providing a real time synchronization of adding and deleting objects.

Please refer to the document "ABB Ability™ Knowledge Manager, core system functional description, 3BHS246232", for more information related to KM.

Figure 26 - Access the KM long time trends

Figure 27 - MinLib KM integration overview

5.3.   Support for process panel 800

The BMI standard symbol library for Process Panel P800 is included in the Minerals Control and Operation Library. The Process Panel 800 interface provides access and control for the following Minerals Library AC800 control modules:

All Process Panel objects have the following common basic functions:

– Manual control from the Process Panel (via commands and input fields)

– Status and operation indication

– Mode selection from the Process Panel (via commands)

– Data exchange through a single access variable

AIS
AOS
DIS
DOS
AIC
AOC
DIC
DOC
MOT1
MOT1VVVF
MOT2
MOT2VVVF
MOTP
VLV1
VLVNO1
GROUP
DriveGroup
PREBIN

For more info consult the documentation: Process Panel Reference Manual 3BHS240189

6.   800xA System Integration

6.1.   Life Cycle Policy

The MinLib follows generally the same life cycle as the 800xA System Software. This means that the product (library) will remain active and supported as long as the corresponding 800xA System Version remains an active product. For every new 800xA System release, a compatible MinLib Version will be made available[2]. A MinLib Version is supporting generally several 800xA Versions. Refer to "3BHF004108-MinLib LifeCylcePlan" for details.

6.2.   Technical and performance data

6.2.1.   System Performance and Capacity

The following chapter summarizes a couple of key numbers by which the 800xA system configuration can be verified. Several parameters will limit the system size and it is highly dependent on the application at hand that determines which parameter will hit the limit first. Direct result of this is, that it is difficult to give any strict system size number. It is even possible to exceed some limits, if other parameters are reasonably below their respective limit. For example, more controllers may be viable if the total data flow between them and to the server and workplace layer is well within the limit.

Regarding the capacity of the connectivity server, performance is heavily dependent on the configuration and the machine hardware. For example, a dedicated connectivity server, ≥3GHz, with 8Gbyte RAM will provide 32 000 OPC-items/second.

6.2.2.   Typical example with Minerals Library

Definition

DEFINITION: Minerals Controlled Object = Loop/Motor/Drive/Actuator/Valve/Group

Assumptions

– On Average, 1 Minerals Object   10 OPC items

– # of Minerals Objects per display   = 200

– # of OPC Items per display   = 2000

– #of screens (Clients) per Connectivity Server= 16

Limitation

– Up to 12000 I/O or 16 simultaneous operator screens (32 000 OPC items) per 1 of 1oo2 Connectivity server with 8GB RAM.

– Workplace PC with 8 GB RAM or more

– The maximums of the platform values always apply.

[2] Generally, an official MinLib release is available in less than 3 months after the 800xA release

Platform values: (see 3BSE041434)	Per system
# of controllers	48 per connectivity server
# of clients (depends on server configuration)	80
# of remote clients (simple viewing client)	10 per remote server
# of connectivity servers	12 out of which 8 for AC800M controllers
# of aspect servers	1 (1oo2 or 2oo3 redundant)
# of Tags (Aspect Object with Faceplate)	60'000
# of Aspect Objects	200'000
# of concurrently updating data points (OPC items)	50'000/second per connectivity server

The latest platform values should always be checked with the ABB Products group before any commitment is made

To achieve smaller latency especially when using VCO graphics together with a 4-screen operator arrangement, a smart usage of the screens like shown in the picture below is favorable for performance. In this setup only 2 screens out of the four are used for process visualization, the other screens are used for the alarm list and trend displays. Also, it shall be considered to limit the Max number of windows with the 800xA View Class configuration.

Figure 28 - 4 Screen Layout

Generally, we suggest to:

- Follow the example and best practice of the MinLib Document 3BHF004109- MinLib OverviewGettingStarted.

- Make sure to match the HW requirements described in "3BSE041434-611_B_en_System 800xA 6.1.1 System Guide - Technical Data and Configuration"

For the operator station workplace (workstation) the following specifications are recommended especially when using VCO graphics:

- a CPU clock speed above 3 GHz and 4 Cores, as a high number of processor cores cannot compensate for a slow processor speed.

- Avoid using silent pc with fan less CPU cooling, as they tend to have poor performance. Consider using a KVM solution and using large and powerfully workstation in a separate room. A solution to be considered especially for EOWs.

- Discrete graphics card, usually provides better performance then processor embedded graphics

- Best performance is achieved with M.2 NVMe, but make sure to use solid state disk, as low disk latency is an advantage

Estimation based on Controlled objects

PM862**:**   100 controlled objects per controller

PM866:   200 controlled objects per controller

PM891:   360 controlled objects per controller

For the following two controller load estimations, it is assumed that more than half of the cyclic controller load is due to "application glue logic"

Expected Results

CPU Execution time **500ms for all objects,** **50 to 150ms for dedicated part of the code (e.g. stop on limit switch, local start/stop)**	**Results in about 45% CPU cyclic load**
I/O to HMI time	Approximately 1.5 s
Download time per node	Less than 60 s
HMI update stop during download	Less than 5 s
S800 I/O on Profibus, DI and DO minimal scan time	Approximately 120ms with 1200 I/O per bus

6.2.3.   System Example

The following picture illustrates the maximum capacity values in terms of I/O signals (HW I/O and SW signals) in an application that has a mixture of 20% analogue signals and 80% digital signals. Note that this conversion to I/O signals is purely mathematical and fully based on the mixture of analogue/digital given above. It is made to help in practical configurations where normally only the number of I/O's is known. Changes in the mixture will impact the maximum limits, that is, an increase of analogue signals will reduce the maximum limits.
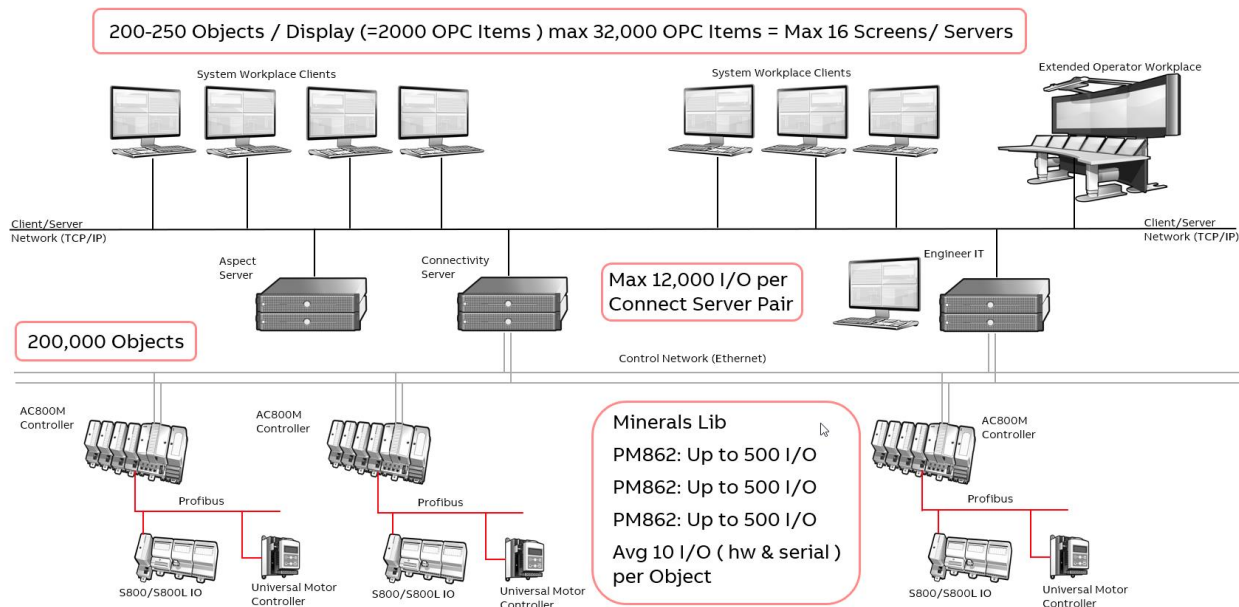

Figure 29 - System Architecture

6.2.4. Memory Space Requirements and Execution Times

The following table shows the memory space requirements and typical execution times for the AC800M Minerals Library control modules. The execution times and the memory requirements were measured using a PM866 and the Control Builder TC1 Version 6.0.0.-0, with the 5.1/5b release of the Minerals Library.

For more information about execution times for I/O, see AC800M User's Guide.

Note that the Control Modules make heavy use of conditional execution and the Peak Load (esp. Alarm Generation) is multiple times higher than the typical load.

Our experience has shown that the cyclic load is 2 times higher because of hardware execution time and the glue logic used between the MinLib blocks.

| Control Module | Execution Time | | | |
| | AC800 PM866 | | | |
6p0s0	Normal Tas [ms]	PreBin [ms]	ConPu [ms]	Fast Task [ms]
AIS	0.160	0.000	0.000	0.000
AOS	0.126	0.000	0.000	0.000
DIS	0.020	0.000	0.000	0.001
DOS	0.003	0.000	0.000	0.000
AIC	0.103	0.000	0.000	0.000
AOC	0.015	0.000	0.000	0.000
DIC	0.023	0.000	0.000	0.000
DOC	0.002	0.000	0.000	0.000
MOT1	0.250	0.008	0.000	0.010
MOT1_VVVF	0.350	0.007	0.000	0.008
MOT2	0.340	0.014	0.000	0.012
MOT2_VVVF	0.530	0.013	0.000	0.012
MOTP	0.360	0.020	0.000	0.013
VLV1	0.115	0.007	0.000	0.011
Actuator	0.331	0.020	0.000	0.000
Group	0.156	0.000	0.000	0.000
DriveGroup	0.433	0.013	0.000	0.000
Subgroup	0.237	0.007	0.000	0.000
PREBIN	0.040	0.017	0.000	0.000
STW	0.017	0.000	0.000	0.000
PIDCtrl	0.570	0.020	0.000	0.000
PIDAdvCtrl	1.073	0.020	0.000	0.000
GCC_Com_M	0.037	0.007	0.000	0.000
GCC_Com_S	0.030	0.000	0.000	0.000
PCC_Com_Drive	0.020	0.000	0.000	0.000
PCC_Com_Signale	0.023	0.000	0.000	0.000
Pulse Count	0.010	0.000	0.000	0.000
PCC_Threshold_And3	0.027	0.000	0.000	0.000

Figure 30 - Load Estimation Table

Note: There is a calculator for cyclic load estimation, available on the MinLib SharePoint (abb.sharepoint.com/sites/MineralsLibrary/ -> Documents -> CommercialAndHelp) or to be requested by email to the mineralslibrary.orderbox@ch.abb.com

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Approved	Public	3BHS161554-613	F	en	55/68

6.2.5. Performance Data

Application Performance Data

The SystemDiagnostics Interaction Window can be used online to check the performance of the running controller with the loaded application. To ensure the application reliability, you should pay attention to the following points: Cyclic Load should not exceed 50%. Changing the application task connection and / or the task properties (period time) influences the load.
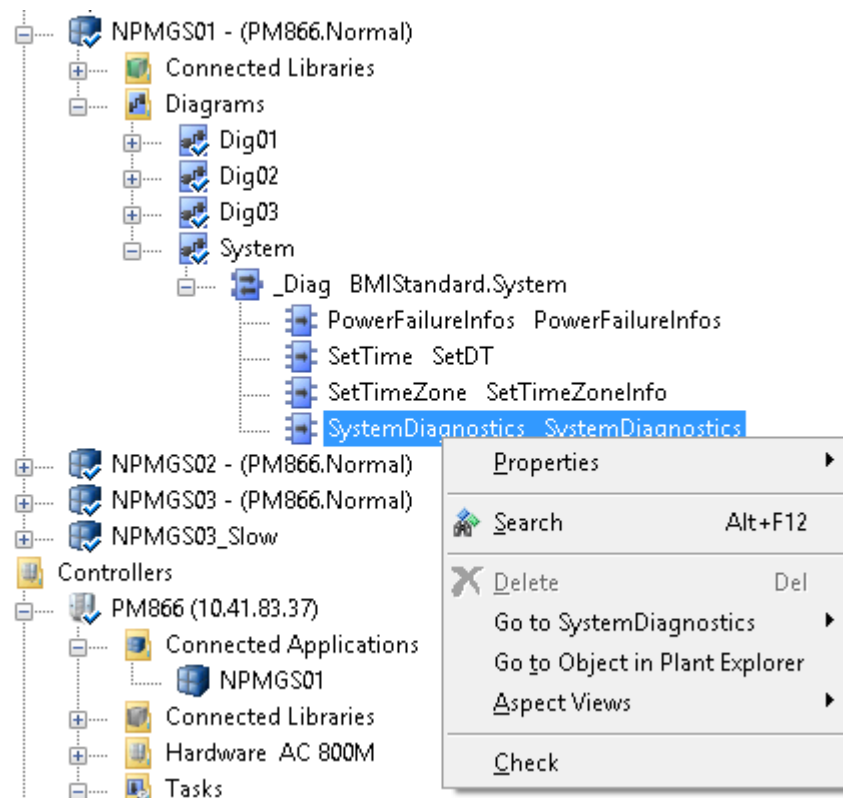
Used memory should not exceed 50%. Otherwise successful download of changes during running cannot be guaranteed in all cases and stop time could increase if there is not enough free memory during download.

Figure 31 - System Diagnostic Interaction Window

This interaction window can be found in the System Control Module

6.3.   Licenses and ordering Minerals AC800M Control and Operation

This section aims to help project personnel when ordering the Minerals Library for integration with System 800xA SV6.x Control and Operations products.

Preferably, use Wizard 800xA with the Minerals 3BHS128715/x.wcat and 3BHS128715/x.wprc installed. Ordering is made using the EDI file generated by Wizard Order module and sending it to MineralsLibrary.OrderBox@ch.abb.com.

6.3.1.   Minerals Library License

Minerals Library License is sized using the minerals license points (MLP). Minerals Library does not use a Tag license (Tag). This is to simplify the ordering and handling of the licenses.

Since version 5.1 and introducing the Minerals license enforcement in the system, the Minerals License size is counted based on the effective application size using Minerals Library. Only the MLPs related to Minerals applications are considered in the license size.

Prerequisites for use of the Minerals Library:

– The System 800xA Base System and its standard system libraries are installed and licensed.

– Minerals Library licenses for the number of used MLPs have to be ordered.

– Minerals Library has to be installed and added as a system extension, refer to release notes for help regarding the installation.

– The license Key (in form of an .SLA file) for the Minerals Library has to be generated in ABB Software Factory and installed in the 800xA system licensing server.

6.3.2.   MLPs - Minerals License Point

The Minerals License Points are calculated by the number of used Minerals Library Control Modules:

Type of Block	MLP count
Digital I/O (DIS, DOS)	1
Analog I/O (AIS, AOS)	2
Consumer Objects (MOTx, MOTX_VVVF etc.)	5
Loop Objects (PIDCtrl)	4
Circuit Breaker	5

6.3.3.   Ordering Examples

The media with the software and documentation can be ordered when required, but generally we do suggest downloading the software from the SharePoint (details in 1.3). From the Price List for 1.2 Control and Operation; AC800M; Minerals Library 6.0/x:

1 of   Control&Operation; AC800M; MineralsLib6.0/x; SW&DocCD

Ordering Example 1

For this example, take the following configuration: Three controllers with different capacity and different MLPs.

- Controller 1 has 350 MLPs

- Controller 2 has 550 MLPs

- Controller 3 has 1100 MLPs

The above configuration requires the price list items listed below.

From the Price List for 1.2 Control and Operation; AC800M; Minerals Library 6.0/x:

System-wide license for 2000 MLPs (350+550+1100) is calculated as follows:

01 of Control; AC800M; MineralsLib6.0/x; BaseLic   3BHS200491R04

20 of Control; AC800M; MineralsLib6.0/x; 100 MLP;<=5000 MLP   3BHS200492R04

Ordering Example 2

For this example, assume 8000 MLPs are required, this needs the price list items listed below.

From the Price List for 1.2 Control and Operation; AC800M; Minerals Library 6.0/x:

01 of   Control; AC800M; MineralsLib6.0/x; BaseLic   3BHS200491R04

50 of   Control; AC800M; MineralsLib6.0/x; 100 MLP;<=5000 MLP   3BHS200492R04

30 of   Control; AC800M; MineralsLib6.0/x; 5001-20000 MLP   3BHS200493R04

7. System 800XA Operations AC400 Connect Minerals Library[3]

Operations AC400 Connect Minerals Library integrates the BMI AC400 Type Circuit Library with the 800xA Operator Workplace. The AC400 Connect Minerals Library provides display elements and Faceplates on the Process Portal, for monitoring and control of objects defined by means of the BMI AC400 Type Circuit Library. These are intended for sites with an installed base of AC400 controllers and AS500 that need to connect to the Process Portal.

The process display elements and Faceplates have the same look and feel, as well as similar functionality as the AC800M Connect elements listed above. There is a display element and a Faceplate for each BMI Type Circuit Library element in the AC400.

7.1. Licenses and Ordering PPA AC400 Minerals Connect

Preferably, use Wizard 800xA with the 3BHS128715/x.wcat and 3BHS128715/x.wprc installed. Ordering is made using the EDI file generated by Wizard Order module.

Tag

The licensing system for AC400 Connect is based on calculating Tags. A Tag represents an object regardless of the number of data points it holds, examples are:

– signal objects, i.e. AI, AO, etc.

– motor, valve objects

– generic OPC items with one or several OPC properties

– user defined object types

Licenses

Minerals AC400 Connect is an add-on to standard System 800xA AC400M Connect and both licenses are required.

Minerals AC400 Connect contains display elements and Faceplates for the BMI AC400 objects/type circuits.

Prerequisites for use of this software:

– The System 800xA SV5.x Core System is installed, with the AC400 Connect Option.

– The AC400 controllers have the BMI Type Circuit Library installed.

[3]The detailed AC 400 Connect Minerals Library description has been removed from the product guide. Please refer to following documents for additional information

01 Minerals Library AC400 Overview

02 Minerals Library AC400 Basic Objects

03 Minerals Library AC400 Loop Objects

04 Minerals Library AC400 Consumer Objects

05 Minerals Library AC400 Group Objects

Minerals Library AC400 Release Notes

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Ordering Example

Assume the following configuration:

– Controllers, with different capacity and different Controller License Points (CLPs).

– Three Process Portal workplaces

The tag count is calculated at 17'000 tags.

This configuration requires the following licenses:

From the Price List 1.6 Operation; AC400M Connect; Minerals Library 5.1/x:

System-wide license for 17'000 tags is calculated as follows:

01 of Operation; AC400Connect; MineralsLib5.1/x;BaseLic   3BHS200501R02

07 of Operation; AC400Connect; MineralsLib5.1/x;1000Tags   3BHS200503R02

01 of Operation; AC400Connect; MineralsLib5.1/x;10000Tags   3BHS200504R02

The CD-ROM with the software for above functions should also be ordered.

01 of Operation; AC400Connect; MineralsLib5.1/x;SW&Doc CD   3BHS200505R02

8. Support and training

8.1. Minerals support

The MinLib provides technical level 4 support. A request can be raised by any ABB unit over the mailbox global-mineralslibrary.salessupport@abb.com.

8.1.1. Design Review

ABB offers the service to execute a Design Review for the 800xA system configuration and application design in a Minerals delivery project. This review is based on defined documents and will be executed by the Minerals Library Development Center or by a certified engineering unit.

Within ABB this review service is mandatory in projects where Minerals Library certified personnel is not available. The Design Review Service can be ordered from Minerals Library price list. The Service fee contains the coverage of the working hours at the home location of the executing unit. Possible expenses for executing the review in another location must be covered by the ordering unit.

8.1.2. Life Cycle Services

Please see the price list for Minerals: Life Cycle Services for ordering 24 hours or other support for Minerals Library.

8.2.   Minerals training courses

Training is an important part for successful project engineering and hence a prerequisite for certification.

Please see the schedule and information from the Cement, Minerals and Mining Learning Center – ABB University Switzerland for training that is available on the Minerals Control Libraries.

For ordering, see the price list for:

– IndustrialIT 800xA Applications for Minerals – Engineering with EBase and Control Builder M (CHH658)

– IndustrialIT 800xA Applications for Minerals – Configuration and Operation (CHH651)

– IndustrialIT 800xA Applications for Minerals – Operation (CHH652)

– IndustrialIT 800xA Applications for Minerals – Configuration and Operation Utilizing BMI Library (CHH653)

8.2.1.   CHH658 – Engineering with EBase and Control Builder M

Duration 7 days.

Objectives

Participants will follow the engineering workflow and utilize Engineering Base (EBase) to handle bulk data and create Minerals control applications for System 800xA with AC800M Controllers efficiently and professionally.

Upon completion of this course, students know the basic functionality of EBase and know how to set up a project and import customer data in EBase. Using EBase, they can configure Minerals control applications and generate bulk data via typicals. They know how to export the prepared application from EBase to Control Builder M, where they will finalize it by programming the interlock (glue) logic for the different consumer and group objects. They can use the import / export, download / upload and copy functions. They know the detailed functionality of the different objects in the Minerals Library with the required data types and understand the program structure.

Contents

– Engineering workflow

– Minerals Library

– Introduction to EBase Electrical

– Application configuration with EBase

– Import customer data

– Generate object related signals

– I/O allocation

– Configure objects and start/stop sequences

– Parameterized Interlocks and Preselections

– Export to Control Builder M

– Programming of interlock (glue) logic

    –   Download to Controller AC800M and online test

Methods

The course flow is based on a practical exercise, where students will configure and program a complete Cement Transport Group. Group. Lectures and demonstrations are done before each main exercise. The teacher then guides the students through the exercises, step by step.

Participants

Engineering and planning personnel responsible for the bulk data handling and control programming for Minerals applications at the start phase of the project.

Prerequisites

Attendance of course CHH561.

8.2.2. CHH651– Configuration and Operation

Duration 10 days.

Objectives

Participants learn the operation and configuration of the IndustrialIT Extended Automation System 800xA by using the Minerals application libraries.

Upon completion of this course, the students know the architecture of the automation system and the hardware components of the controller. They know how to configure, modify and test controller application programs with the Control Builder M programming tool. They are able to operate the user interface Process Portal and can configure process graphics, trends and alarms. They know the basic functionality of the different objects in the Minerals Library with the required data types and understand the program structure.

Contents

– System 800xA architecture

– Controller AC800M Hardware Configuration

– Plant Explorer, Engineering Workplace and Control Builder M

– Variables and Data types

– Monitoring and testing applications

– Programming according to IEC 61131-3,

– Function Block Diagram (FBD) and Structured Text (ST)

– Advanced configuration with Control Modules and Structured Data Types

– Minerals Libraries and Minerals Applications

– OPC Communication

– Operator Workplace

– Configure Process Graphics

– Configure Alarm and Events

– Configure Historical Data Collection and Trend Displays

– Backup / Restore of the System

– Workshop Engineering

Methods

Lectures, demonstrations and practical exercises. At the end of the course a workshop is done. This workshop covers a larger exercise and is used to consolidate the most important items from the training which the students will need for their future work.

Participants

Engineering, planning, operating, commissioning, maintenance and service personnel, working in the field of Minerals Applications

Prerequisites

Students should know the fundamentals of working with Control Systems, have basic knowledge of Windows Operating System and of technical English.

8.2.3. CHH652 Industrial IT 800xA Applications for Minerals – Operation

Duration 2 days.

Objectives

Participants learn to operate a plant that is controlled by an IndustrialIT Extended Automation System 800xA, based on Minerals application libraries.

Upon completion of this course, the students know the basic system architecture and are able to log on into the system. They understand the user interface Process Portal and know how to navigate through the system. They know the basic functionality of graphic displays and Faceplates. They are able to monitor and control relevant objects of the plant. They know how to acknowledge alarms and can use event and alarm lists as well as trend displays.

Contents

– Overview of the IndustrialIT 800xA System

– Basic System architecture

– Operator interface

– Navigation through the system

– Graphic displays

– Faceplates

– Operation

– Basic objects

– Consumer objects

– Group objects

– Loop objects

– Events and alarms

– Historical data and trend displays

Methods

Lectures, demonstrations and practical exercises

Participants

Operators who need to control and supervise the plant

Prerequisites

No special knowledge required

8.2.4. CHH653 – Configuration and Operation Utilizing BMI Library

Duration 5 days.

Objectives

Upon completion of this course the participants should be able to:

– Monitor and control the BMI minerals process objects

– Navigate in the system and create new objects and aspects using Plant Explorer

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- Use the standard libraries and the Minerals Library as well as create project specific libraries

- Design and configure applications using Control Diagram Editor (CDE) within CBM utilizing BMI Library

- Customize and use the operator's workplace and its functions and operate the Minerals Library objects

- Configure process graphic displays and define navigation links

- Manage and configure events and alarms

- Use the import/export tool

- Backup and restore the System 800xA

Contents

- Operating minerals process objects

- Overview of BMI Library

- Data types in BMI Library

- Application and system structures utilizing BMI structure

- Using Control Diagram Editor (CDE) for programming applications with functions, function blocks and control modules utilizing BMI Library

- Monitoring and testing applications

- Minerals Library and minerals applications

- Task assignment and memory (optional)

- IAC communication

- Operator Workplace (based on tabbed workplace)

- Process graphics

- Import/export tool (optional)

- Backup and restore of the System 800xA (optional)

- Workshop engineering

Methods

This is an instructor-led course with lectures, demonstrations, interactive discussions and practical exercises. At the end of the course a workshop is done. This workshop covers larger exercises consolidating the most important items from the training which the students will need for their future work.

Participants

This training is targeted at engineering, planning, advanced operating, commissioning, and maintenance and service personnel working in the field of minerals applications.

Prerequisites

Participants should know the fundamentals of working with control systems and have basic knowledge of the Windows XP or Windows 7 operating system, 800xA configuration and programming and technical English.

9. Revisions

Rev.	Page (P) Chapt. (C)	Description	Date Dept./Init.
A	All	Initial draft	2018-01-31/AT
B	All	Release 6.0/2 and ControlConnection update for 6.0/3	2018-09-01/GS
C	All	Adaption for VisualControl VCO	2019-04-28/AT
D	All	Adaptions for 6.1/1	2020-02-28/NC
E	All	Update for VCO MinLib 6.1/2	2021-11-11/JM
F	All	Update for VCO MinLib 6.1/3	2022-12-12 /GS