MAPS

LIFE-CYCLE ENGINEERING

Optimised for MITSUBISHI ELECTRIC FACTORY AUTOMATION

e-F@ctory Partner Product

Technical Description

Adroit Technologies

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1. OVERVIEW

MAPS stands for Mitsubishi Adroit Process Suite, an integrated software solution that combines the separate development tools of Mitsubishi Electric, Adroit Technologies and DesSoft.

- Mitsubishi Electric manufactures PLCs and Drives for the automation industry.
- Adroit Technologies develop the Adroit SCADA and associated software
- DesSoft develop engineering design tools

MAPS is focused around offering an integrated PLC/SCADA programming and management tool that works seamlessly with the Mitsubishi Q-series PLC hardware and the tried and tested Adroit Agent Server and through the Mitsubishi GX-IEC Developer or GX Works 2.

MAPS delivers value along the entire life-cycle and value chain of any automation solution, from the initial process design, the engineering phases by providing a more structured approach to projects, which enforces the use of re-usable objects and standards and structure.

MAPS, however, goes one step further to address the shortcomings of current offerings and solutions around the commissioning, handover and operations phase of an automation project. By using the tools developed by DesSoft to ensure that all drawings, documentation and PLC and SCADA changes made are kept synchronized and up to date. This prevents the gradual degradation of the delivered solution and associated documentation as a customer maintains and develops the process system along the way and, thereby, ensures that the plant's integrity and efficiency remains at a high level long after the System Integrators have left site.

The MAPS Enterprise Manager is the central integrated engineering solution for your documentation, PLC programming and SCADA engineering - giving you a project life-cycle management solution.

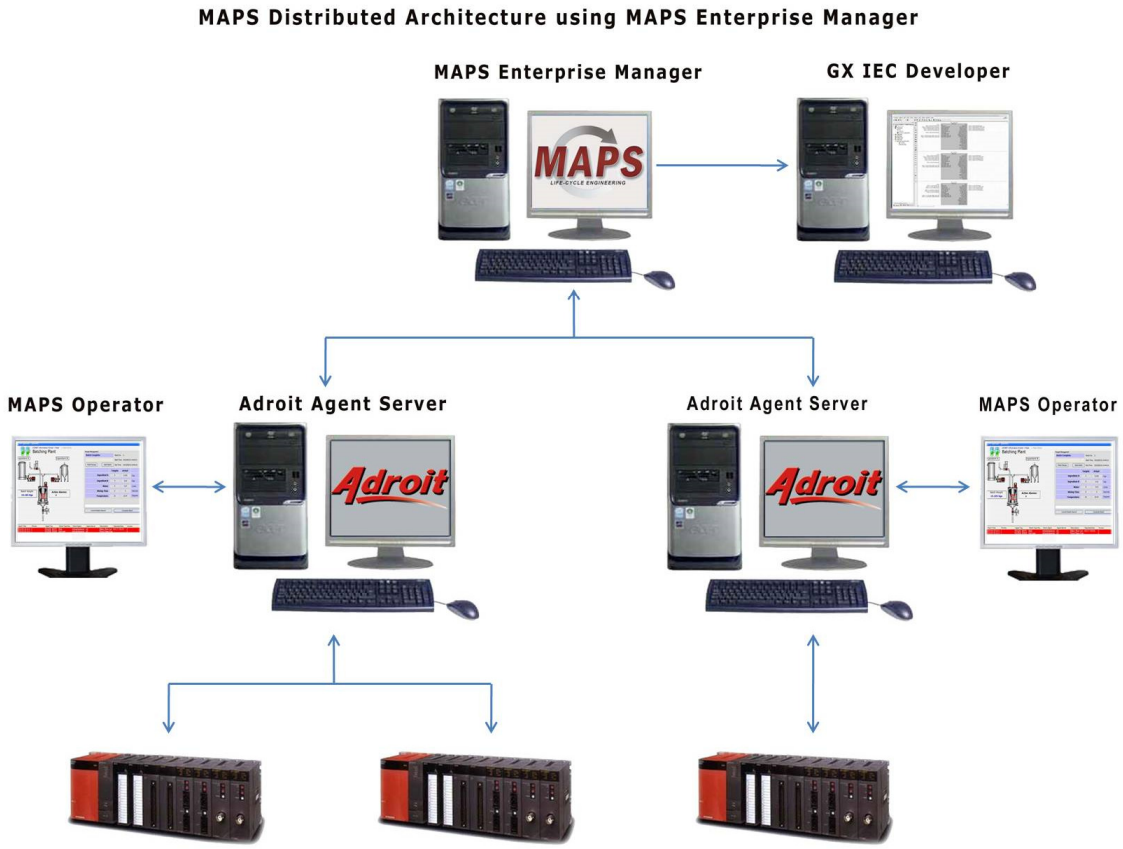


Figure 1 MAPS Distributed Architecture

2. MAPS PROJECTS

We need to explain why and how MAPS provides a more structured approach to projects, enforcing the use of re-usable objects and standards and structure - so that you can better understand some of the benefits provided by MAPS.

Firstly, it needs to be said that MAPS is not a magical tool that does all the thinking and work for you. In fact using MAPS forces you to think and to plan ahead of time – since the key to a successful automation project is PLANNING. So you should do the following before creating a MAPS project:

- Create a comprehensive schedule of all the electrical and instrumentation equipment required in the plant, which are organized according to the following extended physical model of the hierarchical structure specified by the ISA S88 and S95 standards:

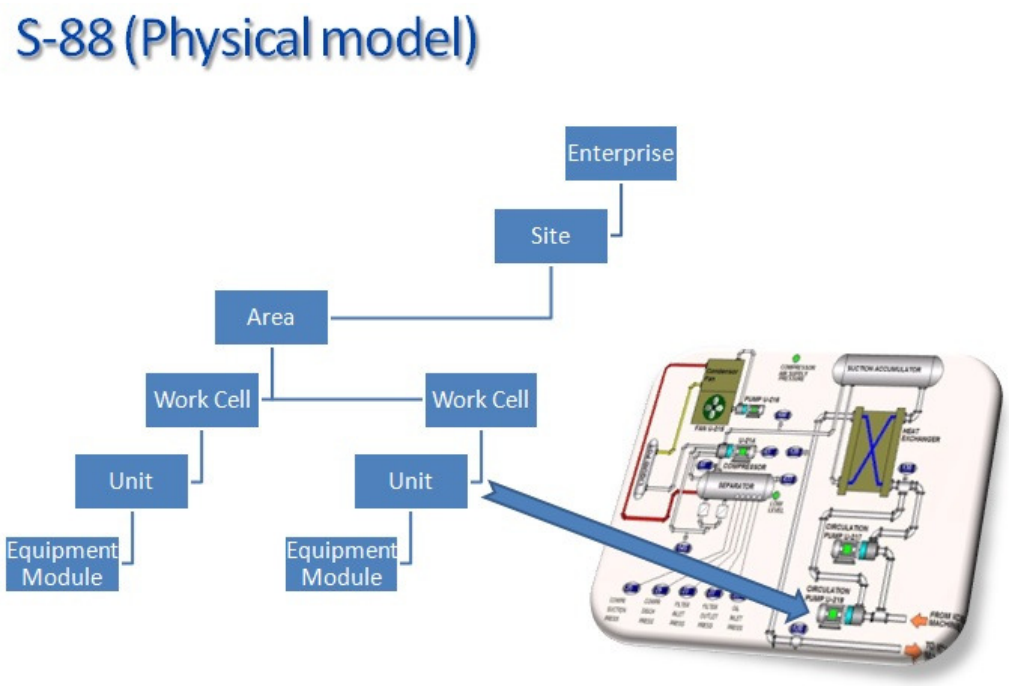


Figure 2 The MAPS S88/S95 Extended Physical Model

  - The **Enterprise** level is a collection of plants.
  - The **Site** level is the plant (MAPS project). So you will have one MAPS project per site. For example, XYZ Foods.
  - The **Area** level is the defined Plant Area/s of the plant (MAPS project) - Adroit Agent Server. For example, Batching Plant.
  - The **Work Cell** level is the PLC/s of each defined plant area. For example, BATCHING PLC.
  - The **Unit** level is the collection/s of equipment items within each PLC. Typically these relate to the plant area-specific operations, such as Filling, Packing, Flocculation or Batching. However, you can ALSO create a unit for each item of complex equipment i.e. equipment that consist of more than one Electrical or Instrumentation item, such as conveyors.

- The **Equipment Module** level consists of the defined items of equipment that are classified into either the Electrical or Instrumentation categories for each of the defined units.

  NOTE: These hierarchical categories ALL have a 1-to-many relationship with their components i.e. a Site can contain MANY Areas, an Area can contain MANY Process Cells (PLCs) etc.

- Specify and group the IO cards used in each PLC along with the virtual memory addressing to ensure efficient scanning (communication) and allocation by MAPS.

Secondly, MAPS templates are the means by which MAPS enforces the use of re-usable objects, since you need to assign a MAPS template to each **Equipment Module** or item of electrical and instrumentation equipment of your automation solution.

Each MAPS template associates a SCADA graphic (including an intelligent faceplate for operator control) and a PLC function block to an item of equipment. The template also creates the required SCADA tags for its various signals and their PLC variables and links these together.

NOTE: The available MAPS Templates are described in detail in the **MAPS Template Reference** section below.

Thirdly, to take advantage of the complete automation solution life-cycle management provided by MAPS, your design should start with DesSoft's P&ID application and then use EDes to perform the detailed Electrical design and FDes to perform the detailed Instrumentation design. Then use the MAPS-1Engineer to create your MAPS project. This will ensure that all your drawings, documentation, PLC and SCADA changes made are kept synchronized and up to date.

NOTE: You need to purchase these additional DesSoft applications in order to use them.

These DesSoft applications also provide other tools, such as cable sizing, racking and routing and various time-saving tools, such as bulk datasheets etc.

3. USER BENEFITS

3.1 Standards Approach to Projects

Based on ISA S88/S95 standards and using pre-defined IEC Function Blocks (FB) and associated graphics to deliver great value in the testing and commissioning phases of a project.

Function Blocks available in MAPS:

Equipment:

- Direct on line starter (DOL)
  - Advanced
  - Standard
  - Basic
  - Very Basic
- DOL forward and reverse
  - Advanced
  - Very Basic
- DOL 2 speed

- Variable Speed Drive (VSD)
- Intelligent VSD (bus based)
  - Advanced
  - Standard
  - Basic
- Modbus VSD
- Digital Valve – Single Solenoid - Double Sensors
  - Advanced
  - Standard
  - Basic
- Digital Valve – Double Solenoid – Double Sensors
  - Advanced
  - Standard
  - Basic
- Control (Analogue) Valve (FCV)

Instrumentation:

- Analogue In (AI)
  - Advanced
  - Standard
  - Basic
- Analogue Out (AO)
  - Advanced
  - Standard
  - Basic
- Digital Input (DI)
  - Advanced with conditioning
  - Basic with no conditioning
- Digital Output (DO)
  - Advanced
  - Standard
  - Basic
- Flow Meter
  - Advanced
  - Basic
- Janitza Power Meter
- PID Control
  - Advanced
  - Standard
  - Basic
- Totalizer
- Vessel Level
  - Advanced with Analogue and 4 discrete levels
  - Standard with Analogue only
  - Basic with 2 discrete levels

All these blocks have been QA tested and proven in the field offering confidence when commissioning and operating the plant. This allows the control engineers to focus their attention on the physical I/O and the associated plant control program when fault finding.

3.2 Standard, Setup and Diagnostics Faceplates

Each MAPS template provides intelligent faceplates for setup, diagnostics and management tailor-made for the item of equipment it represents. These faceplates are accessed from the SCADA operator view by simply clicking on the representative graphical object.

Although specifically designed for the type and complexity of each item of equipment, all MAPS templates provide a common navigation system and the following functionality to assist both technicians and operators in understanding the control system:

- a filtered alarm and events screen and trend screen
- the applicable interlocks
- a maintenance mode that allows maintenance personnel to use the SCADA as a tool to operate the equipment e.g. stop/start or open/close it etc.
- an advanced configuration screen that in addition to configuring the equipment can provide useful diagnostic information and may provide a built-in simulation capability for easy testing of the solution.

3.3 Single Point of Configuration

The MAPS solution provides a structured single point of configuration, namely the MAPS Designer. However, you can use the MAPS 1-Eng tool to rapidly build your project via an Excel spreadsheet and then use the MAPS Designer to perform the final configuration, such as building the SCADA graphics.

3.4 Automatically Generated Reports

MAPS addresses another big shortfall in automation projects, namely inaccurate reporting. Reports can be generated from the MAPS Designer covering I/O schedules, PLC configuration and SCADA tag configuration. These reports reflect the actual “as-built” status of the project.

Since these reports are generated from a database, new reports always reflect the current status and configuration, which is important from an on-going maintenance point of view.

Both a project and PLC-specific report are available, which can be customized to suit each specific solution.

3.5 Easy Access to PLC program Objects for Diagnostics and Fault-finding

This useful feature expedites commissioning and maintenance, by launching and accessing the correct Function Block by simply right-clicking on the problem piece of equipment in the MAPS Designer – thereby minimising downtime and maximizing productivity.

3.6 User-managed Project Documentation

A useful benefit in that you can add any type of document to the MAPS project and these documents are then made available at runtime via the smart tag access within the MAPS Operator application. For instance, you could add Excel worksheets, PDFs, and/or JPGs to provide easy and controlled access to product specifications, standard operating procedures, drawings etc.

The **FileBrowser** control allows your operators to easily access these documents and allows your engineers to easily manage (add, edit and / or delete) this documentation.

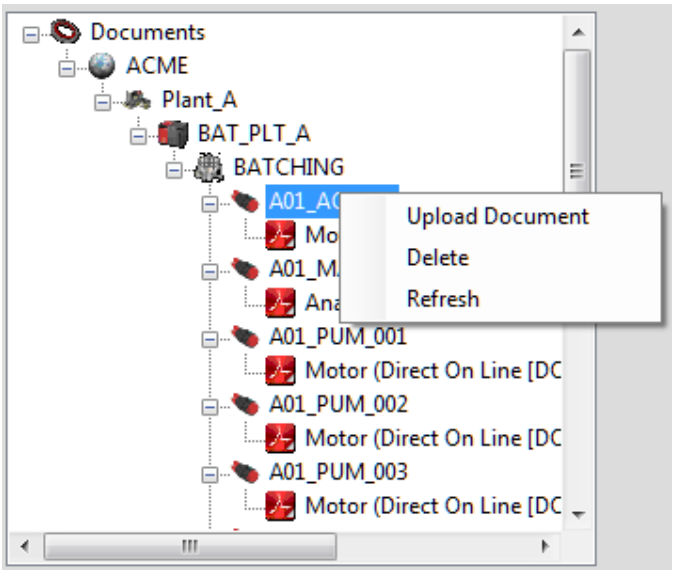


Figure 3 Using the FileBrowser control to access and/or manage project documentation

4. MAPS SYSTEM ARCHITECTURE

Below is the MAPS system architecture, which is a conceptual model defining the structure and behaviour of the various elements that comprise the MAPS project life-cycle management solution:

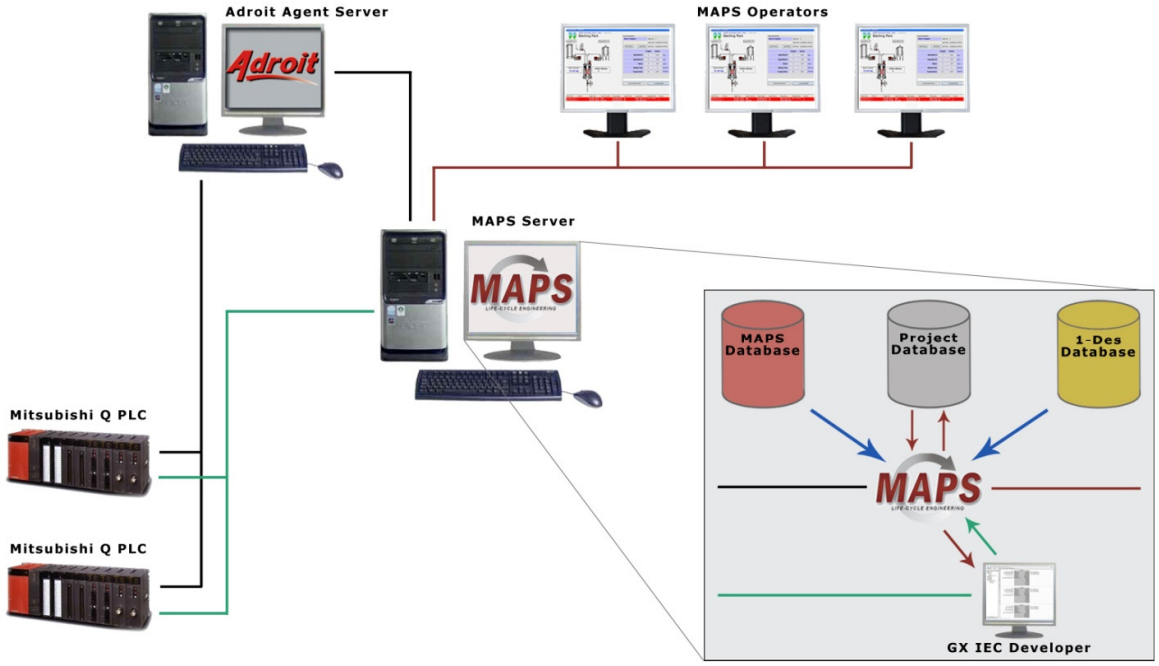


Figure 4 MAPS System Architecture

The hub of the MAPS solution is the MAPS Server:

Firstly, the MAPS Server is connected to the MAPS SQL database on installation. 

This MAPS database is the library of the MAPS templates.

MAPS templates are the means by which MAPS enforces the use of re-usable objects, since you need to assigning a MAPS template to each item of electrical and instrumentation equipment of your automation solution.

Each MAPS template associates a SCADA graphic (including an intelligent faceplate for operator control) and a PLC function block to an item of equipment. The template also creates the required SCADA tags for its various signals and their PLC variables and links these together.

Each MAPS project has its own project database. 

This database is the central repository of the MAPS project, which stores the:

- project navigation structure;
- project hierarchy;
- PLC card addressing;
- MAPS templates used;
- Adroit agent types and agents;
- equipment names, addressing and documentation.

To take advantage of the complete automation solution life-cycle management provided by MAPS, your design should ideally start with DesSoft's P&ID application and then use EDes to perform the detailed Electrical design and FDes to perform the detailed Instrumentation design. All the DesSoft applications use the same DesSoft project database 

. By using the MAPS-1Engineer to bulk configure your MAPS project automatically links this MAPS project (and database) to the DesSoft database. From this point onward, the MAPS project 

and 

DesSoft project databases communicate with each other via an API (application programming interface). This means that any changes made in either MAPS and/or DesSoft databases are replicated to ensure that all drawings, documentation, PLC and SCADA changes made are kept synchronized and up to date.

Secondly, the MAPS Server connects to an Adroit Agent Server (I/O Server) and uses each MAPS Project database to generate a complete SCADA project. This handles the SCADA communication to/from a specific Mitsubishi Q-Series PLC - by configuring the relevant Adroit Agents to communicate (scan) to the required PLC addresses. This communication is represented, in the diagram above, by the black line. ——

Thirdly, the MAPS Server uses each MAPS Project database to generate a PLC program from the function blocks of the specified MAPS templates. The resultant PLC program is a Mitsubishi GX IEC Developer project, which the user needs to download into the relevant Mitsubishi Q Series PLC. The PLC configuration path is represented, in the diagram above, by the green line. ——

The MAPS Operators view/operate the MAPS projects on a MAPS Server. The operational path is represented, in the diagram above, by the maroon line ——

5. MAIN COMPONENTS

From the MAPS system architecture it is clear that the MAPS solution is dependent upon how the MAPS Server interacts with other software components. This section describes the following main software components that interact with the MAPS Server:

- Mitsubishi GX IEC Developer or GX Works 2 (PLC programming software)
- Adroit software (SCADA software)
- MAPS 1-Engineer (Bulk configuring software)
- MAPS Designer
- MAPS Operator

5.1 Mitsubishi GX IEC Developer/GX Works 2

The Mitsubishi GX IEC Developer/GX Works 2 application is launched from the MAPS Designer to create a MAPS PLC program for a MAPS project, by clicking the **Build PLC Project** option. This PLC program is generated from the function blocks of the specified MAPS templates, which are stored in the MAPS Project database, as follows:

- The MAPS Server queries the MAPS project database 

to determine which MAPS templates have been used in this project.

- The MAPS Server references these templates against the MAPS database (MAPS template library) to generate their function blocks and create the necessary GX IEC Developer ASCII project file (.asc).

- The MAPS Designer launches the GX IEC Developer/GX Works application and opens the associated PLC project, so that the engineer can download the required PLC program to each Mitsubishi Q Series PLC.

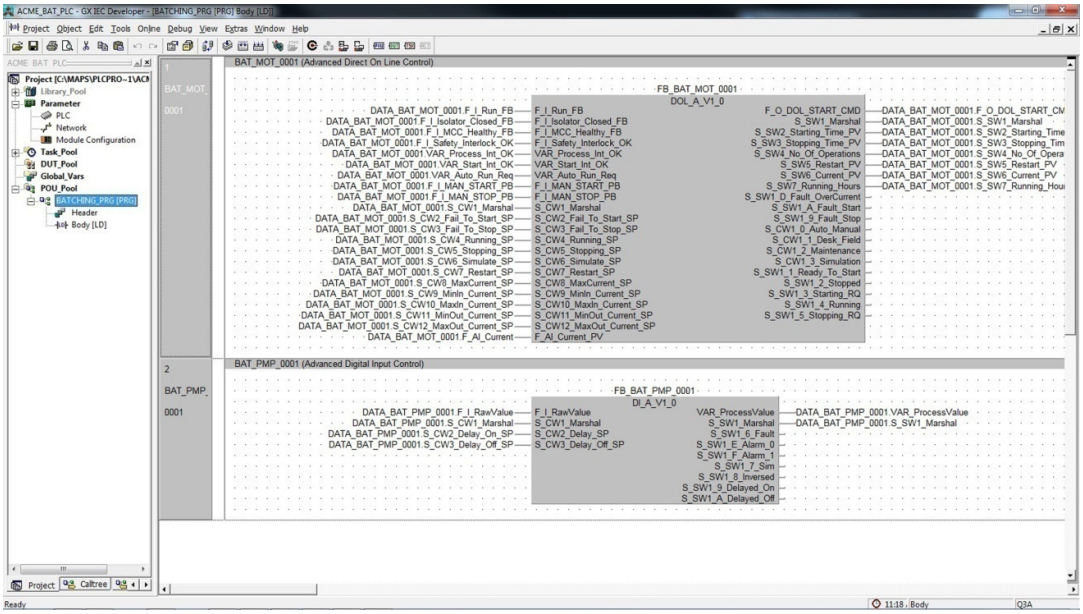


Figure 5 Mitsubishi GX IEC Developer Interface

Then the engineer needs to write the project-specific logic and intelligence for each PLC, which is typically the required interlocking and start-up sequencing.

In addition to generating the initial PLC program, the MAPS Designer provides right click options for the PLC, Unit and Equipment components of the MAPS project to open the GX IEC Developer/GX Works Interface to access the relevant sections of the PLC project.

This ability greatly facilitates the diagnostic and fault finding capabilities provided by a MAPS project. For instance, by right clicking on a problem piece of equipment in the MAPS Designer to view its associated function block in the GX IEC Developer/GX Works Interface.

5.2 Adroit Software

The Adroit SCADA is client-server software and its server component is called the Agent Server. The Agent Server, which in automation speak is known as the real time I/O server, is essentially a collection or repository of intelligent objects known as agents.

Agents are called 'agents' because, instead of only containing data, like simple database records, they also usually contain the ability to operate or act on their own data, driving its values and to read and write to other objects, and so influence them.

Agents are classified by function into a number of agent types, which can be used to implement a wide variety of system related, as well as application-specific tasks. For example, the Analog agent type is used to handle the signal conditioning and alarm checking requirements of a process variable.

For each agent type, there may be zero, one or many agent instances. Each time you add an agent, you are creating a new agent instance, however, agent instances are simply referred to as agents.

Adroit Agent Servers provide consistent mechanisms for creating and destroying agents and efficient means of accessing the information contained within them. There are also no practical limits to the number of different agents, nor indeed types of agents, that can be contained within an Agent Server.

Adroit Agent Servers can concurrently interact with as many clients as may be required. This feature is facilitated by Adroit *agent level locking* which prevents concurrent access to any single agent instance, but permits concurrent access to data contained within different agents.

The Adroit database or .WGP file stores almost all of the data and configuration of the Agent Server, including the added agents, their values and their alarming, logging and scanning configuration. For this reason, it is essential that this file, along with the other Adroit project files, be frequently backed up to ensure that the integrity of this data is preserved.

WGP files provide the following two additional features to assist with their regular back up:

Automatic backup of WGP file on each save: To further ensure that changes made to the WGP file are safeguarded between the regular backups, WGP files can now be automatically backed up each time they are saved.

Version information saved in the WGP file: In addition to providing an audit trail of changes for debugging and troubleshooting purposes, this versioning information can also be used to assist in locating the required backup file when recovering lost changes.

Agent Servers can also be audited, in other words logging the Agent Server's sessions and selected activities performed during these sessions to an OLE DB database. In addition, by using the Audit agent you can log the changes of values that are important to the running of your process, such as set point values and/or alarm limits.

Generally, you will audit the Agent Server to provide a means of recourse in the event of a problem occurring to your process. Examining the audit logs you can determine any of the following user actions:

- when the Agent Server was stopped and started;
- what agents have been added or removed from your Adroit installation;

- what Adroit documents have been saved;
- which audited tags (as specified in the Audit agent) have changed in value;
- who the logged on user was, when these audited events occurred.

The MAPS solution primarily creates Analog and Marshal agents and configures Alarm and DataLog, agents. These agents are briefly described below:

5.3 Analog Agent

An Analog agent stores a floating-point value that has been scaled according to user defined scaling parameters. This scaled value is checked by the agent against the low-low, low, high, high-high and rate-of-change alarm settings. Any infringement of the alarm limits causes the agent to set the appropriate bits in its status word.

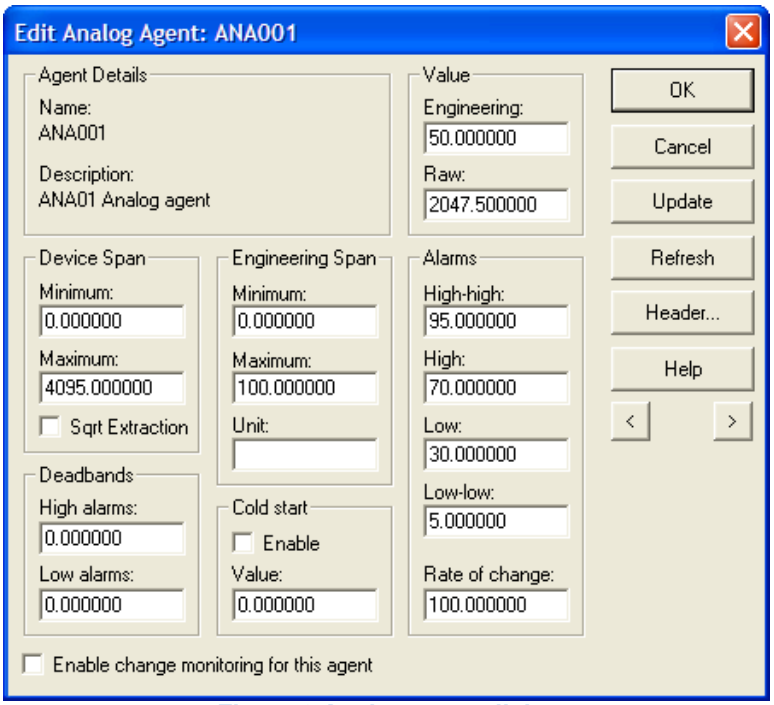


Figure 6 Analog agent dialog

Square root extraction for the linearization of flow signals, alarm deadband settings and cold start initialization options are also settable by the user.

Analog agents provide a change monitoring feature which if enabled, logs an event and sets the Changed status bit when the value slots changes.

5.4 Marshal Agent

The Marshal agent is designed to gather discreet binary data from its 16 bit rawvalue or value slot. By giving, each of these 16 individual bits the full functionality of a Digital agent. In other words, these bits can be separately alarmed, pulsed, named, and the 1 and 0 states of each bit can be named (on/off, open/closed etc). Only the ON state is reflected in the status bit header slots of the agent and therefore the alarming subsystem has been extended to allow the alarming of status bits that are ON or OFF. The rawvalue and value relationship can also be reversed i.e. mirrored.

5.5 Alarm Agent

In Adroit, incidents (alarms or events) are handled by alarm agents, which control the presentation and routing of the alarm events. Typically, each Agent Server is configured to contain an alarm agent that routes the incidents to one or more alarm lists, output devices, audio devices and event logs.

The flexibility in configuring alarms allows the user total freedom in formulating an alarm strategy. Users may create as many alarm *types* as needed, which are the conditions or states of each agent that you need to alarm. Any status bit that is set by an agent can be used for alarming that agent. In this way, the criteria for what constitutes an alarm condition can be left up to an agent to decide. This is why alarming is agent type-specific.

An incident is associated with a routing path, an alarm name and an acknowledgment option, as follows:

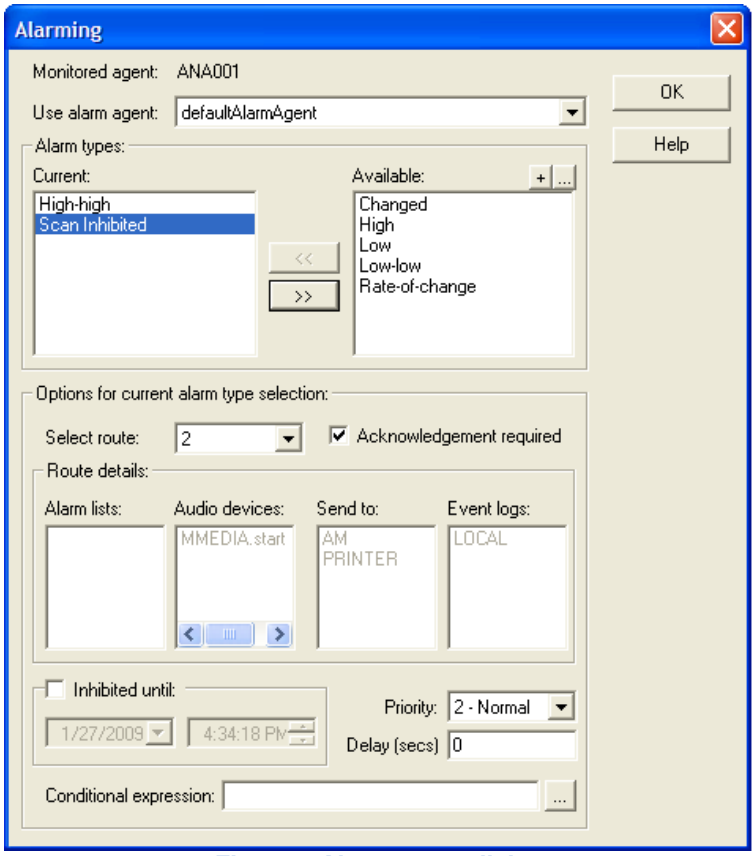


Figure 7 Alarm agent dialog

In the example above, an analog agent ANA001 has an alarm type Scan Inhibited (the user can define any alarm type name), which is activated when the scan inhibit bit (bit 8) in the status word of this agent is set. This incident is routed to the following destinations:

a multimedia agent, which could display a video or play a sound file;

to a local printer for a hard copy record;

to an AlarmManagement agent (AM), which allows you to have efficient and meaningful incident reviews and to identify and remove nuisance alarms and

to the event log on this computer.

Each alarm type can *report* the status of any number of applicable slots. Taking an Analog agent as an example, the type HI can be configured to report the values contained in the *value*, *high alarm limit* and *units* slots to the alarm list. The entry in the alarm list will then show the occurrence of the alarm event together with the actual value of the agent, the engineering units and the associated high alarm limits.

Some key features of the Alarm agent:

You can configure alarm types directly from the Alarming dialog.

You can specify the **Priority** of each incident (**Current** alarm type) in addition to assigning an agent-specific priority, so in the case of an Analog agent the HighHigh incident can have a higher priority than the High incident etc. Typically you prioritize your incidents to ensure that your operators ONLY receive IMPORTANT alarms - since some alarms are critical, whereas others are more informational in nature.

You can configure a **Delay (secs)** for each incident (**Current** alarm type). Typically this is added to delay an active incident from entering the alarm system to prevent intermittent alarms from flooding your alarm system or to ensure that this alarm is raised when the operator needs to respond to it.

You can specify a **Conditional expression** to ensure that each incident is unique and does not duplicate existing active incidents. In this way you can implement first-up alarming, which disregards the incidents that echo existing problems, so that your operators can focus on the real issues at hand.

If necessary you can temporarily suspend the alarming of an incident for a predefined period of time, using the **Inhibited until** option. This option should be used when an alarm indicator may be malfunctioning or may need to be repaired or replaced or in situations when you need to disable ALL the alarms of a particular item of equipment and you cannot disable the alarming of an Alarm agent.

5.6 DataLog Agent

Adroit provides extensive historical logging facilities, either by using the proprietary Adroit data logging facility or by specifying the required OLE DB compliant database to log the data. If this latter method is used, one can specify which table is used for logging this data.

By default, the MAPS templates use the proprietary Adroit data logging facility, when configuring logging. This is because this logging method has been specifically designed for the needs of the SCADA industry. It therefore provides improved logging performance, typically achieving sub-second logging rates. So this logging method is described here.

Any attribute of any agent can be configured to have its values historically logged, subject to the proviso that it is of type *Real, Integer,* or *Boolean.* Logging takes place either to native Adroit binary files. When logged, the values are time stamped and are made available, via a DataLog agent, to any client, such as historical trends, reports, external spreadsheets, etc.

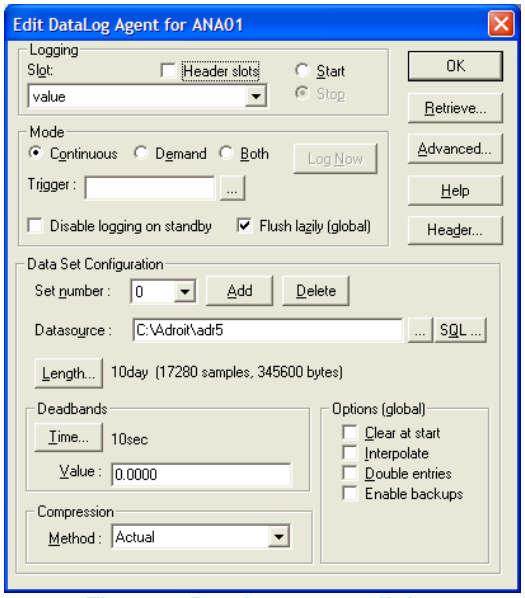


Figure 8 DataLog agent dialog

Select the **Enable backups** option to ensure that the logged data is backed up into multiple CSV files for long-term storage. This logged data backup facility is globally managed by the SystemDataLog agent.

Historical values are stored in a central file, with each DataLog agent "owning" a defined portion of the file. The total amount of disk space required for data logging depends on the total number of values logged, as well as the rate at which and period for which each value is logged. The following formulae can be used to calculate disk file sizes:

Index file size (bytes) = 8 + (56 * number of logged values)

Raw buffer size (bytes) = 20 * (Period/Rate) rounded up to next multiple of 8

Raw file size (bytes) = $\sum$ Raw buffer sizes

Total disk space = Index file size + Raw file size

By default historical logging is an event-based function, in other words values are only logged when they change and only then if the amount of change exceeds the value deadband parameter. When the value of a logged point does not exceed the previously logged value by more than the value deadband, the value is not logged.

Similarly, values that change more frequently than the user-defined time deadband have a value logged that depends on the logging method selected: actual value, average value, minimum value or maximum value, as follows:

- actual: the value logged is the value at the end of the time slice.
- average: a time-weighted average is maintained of all the changes that occur and logged at the end of the time slice.
- minimum: only the lowest or minimum value is logged at the end of the time slice.
- maximum: the highest or maximum value is logged.

The formulae presented above calculate a raw log file size based on the value changing exactly at the logging rate (i.e. worst case scenario). However, in a typical application, a

compression factor of 3 to 5 or more is likely to be achieved. This means that the actual period for which data is retained may be 3 to 5 times longer than the specified logging period.

It is possible to override the default on-change-only logging behaviour and cause values to be logged periodically or according to some other application-relevant trigger criteria.

Historically logged values can be retrieved for viewing within Adroit or exported for further processing as a CSV (Comma Separated Variable) file. This file format is recognized by many commercial spreadsheet and database packages.

Adroit also provides a means of merging values from a .CSV file into an existing historical database of DataLog agents. The .CSV file may have been originally created by the Extract utility or exported directly.

All the other agents of the Adroit Agent Server can be used and manually configured in the MAPS solution - to perform additional functionality and/or to display additional information on the operator display. Below are some of the frequently used agents of the Adroit Agent Server:

5.7 Digital Agent

A Digital agent stores a digital (ON/OFF) value as well as the text descriptions for each of the two discrete states. Value inversion, cold start initialization, alarm infringement checking and a pulsed output option are provided.

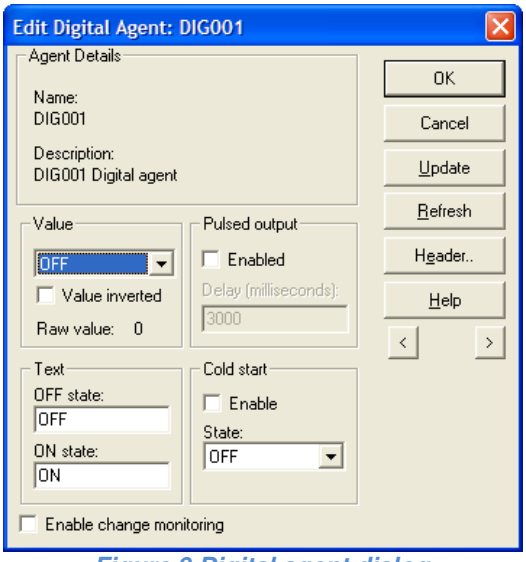


Figure 9 Digital agent dialog

With the pulsed output option enabled, the agent maintains its ON state until a configurable delay has elapsed. As the pulsed output option is applied to the scaled value, inverting the value inverts the effect of the pulsed output.

Digital agents also provide a change monitoring feature which if enabled, logs an event and sets the Changed status bit when the value slots changes.

5.8 Counter Agent

A Counter agent is a simple counter and averager which takes data from any other agents Boolean slots and calculates the time spent on and the time spent off, counts the number of on and off events, and totalizes the on and off time. Each of these values can be individually alarmed (by clicking the **Alarms…** button). This allows you, for example, to generate an event when a motor has started more than a required number of times.

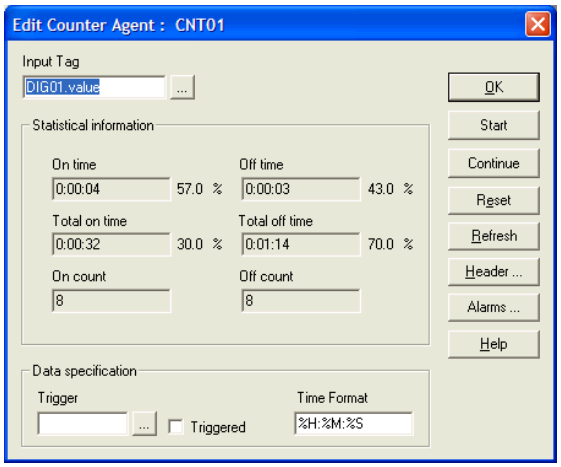


Figure 10 Counter agent dialog

5.9 Expression Agent

The Expression agent type is an extremely powerful mechanism for implementing user-defined calculations. These calculations can be used for a number of purposes, some of the more obvious uses are:

- for constructing control strategies by combining and connecting expressions into arbitrarily complex networks, and for scanning out one or more of the resulting values;
- for enabling or disabling of alarming;
- for enabling logging on a section of plant when a process value exceeds a certain threshold;
- for creating sophisticated animation effects by linking the output of an expression to a display object animation behaviour;
- for creating relatively simple plant simulations by connecting a network of expressions together.

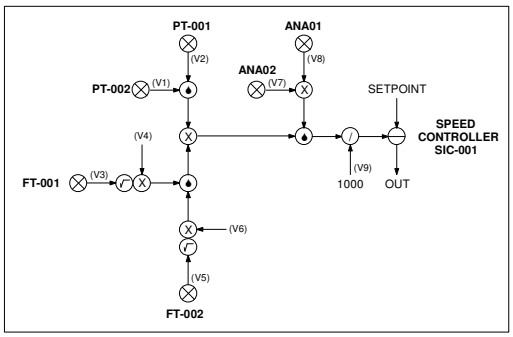


Figure 11 Expression diagram

Each expression agent can contain up to 20 input variables, each of which can be sourced from any other agent attribute or directly from a front-end device. For complex calculations, expression agents can be interconnected with the result of one expression becoming an input to the next.

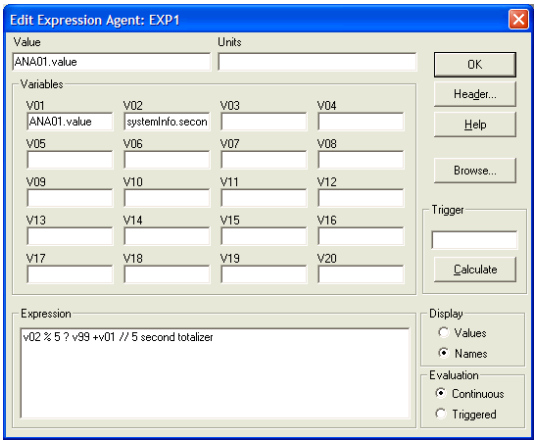


Figure 12 Expression agent dialog

The expression slot contains the actual mathematical expression to be evaluated. To make the expression readable, any number of new lines or spaces is permitted. The expression syntax supported is that of a full ANSI-C expression (i.e. not a partial subset), including sub-expressions nested to an arbitrary depth, conditional operators, bit wise operators, logical operators, relational operators, unary operators, etc, as well as a comprehensive suite of mathematical functions.

The use of variable input names V1, V2, etc, are used in the expression so that it is generic, i.e. by associating different *agent.slot* combinations with the input variable definitions, an expression agent can be reused in many different contexts without changing the actual expression.

An expression can be configured to evaluate either continuously, or on receipt of a trigger pulse (the default). By connecting an expression's trigger input to another agent slot that changes periodically it is possible to cause periodic evaluation of the expression.

Alternatively, the trigger can be connected to some other input, possibly common to a number of other expressions, which may be used to constrain the group of expressions to evaluate, for example, only when data is valid.

5.10 AlarmManagement Agent

Alarm Management is an important aspect of process control required to counteract inefficient alarming. This allows you to create an alarming system that alerts the operator to the most relevant alarm for the current incident. In this case fewer alarms are more effective as the human mind can only focus on a few things at a time.

The AlarmManagement agent logs all incidents and their details, including their time of occurrence, their time of acknowledgement and the time at which they were cleared to a database. This repository of incidents then allows you to:

- Generate statistics from the data produced by the alarming system. This allows you to have efficient and meaningful incident reviews to identify and remove nuisance alarms by analyzing the counts, frequencies, durations and acknowledgement times of alarms.
- Measure KPIs (Key Performance Indicators) to improve your alarming configuration.

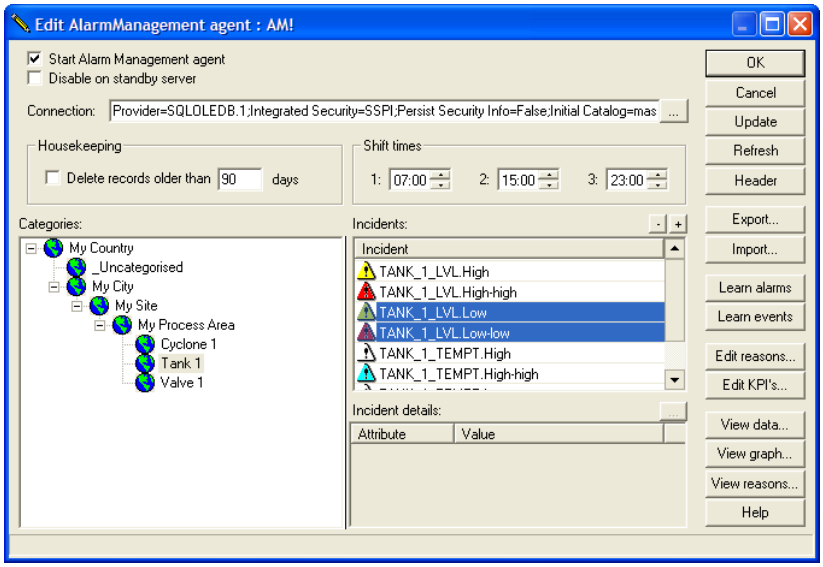


Figure 13 AlarmManagement agent dialog

An alphanumerically sorted **Incident categorization** tree making it easier to find the required incident and/or category; a KPI editor (click the **Edit KPI's…** button) to easily edit the values of the KPIs so they better reflect the goals of your own process and the ability to bulk configure your incidents (**Learn alarms** or **Learn events** buttons).

The AlarmManagement agent requires its own OEM license from the Adroit Agent Server. The associated Alarm Management and Analysis reporting tool helps you to analyze the data provided by this agent to improve your alarming system.

These are only some of the types of agents provided by the Adroit Agent Server. Refer to the **Adroit technical description** or the online Help of the Adroit Agent Server for more information on these and the other available agents. Some examples of other agent types are:

DBAccess agent – allows users to map or retrieve tag values into/from fields of a database.

Script agent – allows users to develop scripting using values of tags that can also interact with the outside world.

SNMP agent – allows users to copy OID values into tags thus turning Adroit into a network management solution.

5.11 Related Documents

Adroit Technical Description:
www.adroit.co.za/downloads/Product Documentation/adroit_7_technical_description.pdf

Adroit Getting Started Guide:
www.adroit.co.za/downloads/Product%20Documentation/adroit_quick_start_guide.pdf

Adroit Product Description:
www.adroit.co.za/downloads/Product Documentation/adroit_product_description.pdf

6. SYNCHRONISING TAGS BETWEEN ADROIT AND THE MAPS PROJECT DATABASE

When creating a MAPS project, each plant Area has an associated Adroit Agent Server that contains the SCADA tags for the equipment within this plant Area

.

As mentioned previously each MAPS template contains a list of the required SCADA tags for the various signals of the specific item of equipment. When the MAPS project is initially created these SCADA tags are typically NOT created in the Agent Server and are only referenced in the MAPS project database.

The MAPS Designer provides the **Sync Tags** command, which can either be applied to a specific plant Area or to a PLC, Unit or specific item of Equipment within a plant Area. This command compares the SCADA tags that are referenced in the MAPS project database with the SCADA tags that are created in the Adroit Agent database (.WGP) file of the Adroit Agent Server associated with the required plant Area.

Therefore, when you first perform the **Sync Tags** command for a plant Area of a newly created MAPS project, the associated the Adroit Agent database (.WGP) file is usually empty – so you need to create all the SCADA tags for the equipment in the relevant Adroit Agent Server.

IMPORTANT: In addition to creating the applicable SCADA tags, this also performs any other necessary SCADA configuration, as specified by each MAPS template, such as scanning, logging, alarming and/or trending. So the end result is a completely configured SCADA system.

This command displays the following list of SCADA tags that differ between the MAPS project database and Adroit Agent database (.WGP) file. The **Sync** column indicates where each differing tag needs to be created, in this case the Adroit Agent Server:

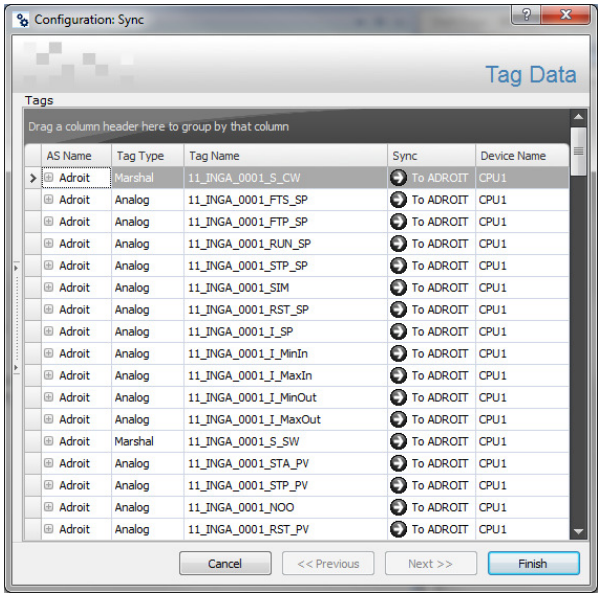


Figure 14 Synchronising SCADA tags between Adroit and the MAPS project

Later on, you can perform this same **Sync Tags** command to update a running system. This will highlight all the changes that have been made in either the MAPS project database or the relevant Adroit Agent Server - so that these tag changes can be synchronised in the same way.

7. MAPS1-ENGINEER

The MAPS-1Engineer is a DesSoft component that is shipped standard with the MAPS product. By ONLY using this DesSoft component you can:

- bulk configure your MAPS project, by creating and importing an Excel spreadsheet to create your list of electrical and instrumentation equipment for your plant site and plan the IO of each PLC.

	A	B	C	D	E	F	G	H	I	J
1	Plant Area Name (S88 Plant Area)	Plant Description	Plant Area Code	MAPS Server	Adroit Datasource Name	PLC Name (S88 Process Cell)	Adroit Device Name	Process Unit (S88)	Equipment Tagname	Description
2	Plant_A	ACME Plant A	A01	Default	Adroit	BAT_PLT_A	PLCA	BATCHING	A01-MAS-001	Mixing Tank Weight
3	Plant_A	ACME Plant A	A01	Default	Adroit	BAT_PLT_A	PLCA	BATCHING	A01-AGI-001	Mixing Tank Agitator
4	Plant_A	ACME Plant A	A01	Default	Adroit	BAT_PLT_A	PLCA	BATCHING	A01-PUM-001	Mixing Tank Water Pu
5	Plant_A	ACME Plant A	A01	Default	Adroit	BAT_PLT_A	PLCA	BATCHING	A01-PUM-002	Ingredient A Pump
6	Plant_A	ACME Plant A	A01	Default	Adroit	BAT_PLT_A	PLCA	BATCHING	A01-PUM-003	Ingredient B Pump
7	Plant_A	ACME Plant A	A01	Default	Adroit	BAT_PLT_A	PLCA	BATCHING	A01-TEM-001	Mixing Tank Tempera
8	Plant_A	ACME Plant A	A01	Default	Adroit	BAT_PLT_A	PLCA	BATCHING	A01-VAL-001	Mixing Tank Steam Va
9	Plant_A	ACME Plant A	A01	Default	Adroit	BAT_PLT_A	PLCA	BATCHING	A01-VAL-002	Mixing Tank Drain Va
10	Plant_A	ACME Plant A	A01	Default	Adroit	BAT_PLT_A	PLCA	BATCHING	A01-STT-001	Batching Process Star
11										

Equipment Schedule | IO Allocation

Figure 15 Equipment Schedule worksheet of the Sample Maps ImportSheet

- specify the layout of your racks in each PLC and finalise their IO cards (this means ensuring that the IO cards have sufficient capacity for the IO of the equipment associated with each PLC)

PLC Name	Description	Rack	Slot	IO Type	Chnl Count	Start Address				IO Summary		
BAT_PLT_A	QX81 - 32 Channel Digital I	00	00	DI	32	X00						
BAT_PLT_A	QX81 - 32 Channel Digital I	00	01	DI	32	X20				IO needed per PLC		
BAT_PLT_A	QY81P- 32 Channel Digital	00	02	DO	32	Y40	X - is Optional			PLC Name	IO Type	IO Count
BAT_PLT_A	Q68ADI - 8 Chanel Analogu	00	03	AI	8	60	Y - is Optional			BAT_PLT_A	DI	58
BAT_PLT_A	Q68DAI - 8 Chanel Analogu	00	04	AO	8	80				BAT_PLT_A	DO	10
BAT_PLT_A	Used for Analogue In	Virtual	IO	AI	8	D01024	D	1024		BAT_PLT_A	AI	14
BAT_PLT_A	Used for Analogue Out	Virtual	IO	AO	8	D01032	D	1032		BAT_PLT_A	AO	2
BAT_PLT_A	Used for Remote Inputs	Virtual	IO	RI	0	D01040	D	1040		BAT_PLT_A	SCL	182
BAT_PLT_A	Used for Remote Outputs	Virtual	IO	RO	0	D01040	D	1040		BAT_PLT_A	SSL	76
BAT_PLT_A	SCADA Control - Low Scan	Virtual	IO	SCL	100	D01040	D	1040				
BAT_PLT_A	SCADA Control - High Scan	Virtual	IO	SCH	0	D01140	D	1140				
BAT_PLT_A	SCADA Status- Low Scan Ra	Virtual	IO	SSL	50	D01140	D	1140				
BAT_PLT_A	SCADA Status- High Scan R	Virtual	IO	SSH	0	D01190	D	1190				

Figure 16 The IO Summary and PLC fields used to finalise your IO cards

NOTE: This functionality is NOT provided when using the MAPS Designer to create the entire MAPS project.

In addition, the MAPS-1Engineer application allows you to create or view reports such as Motor lists, Instrument lists, Cable lists, Instrument Costing, Cable Costing, etc.

If you are using the other DesSoft applications, this method of creating a MAPS project also links this MAPS project database to the DesSoft project database, after which these project databases are automatically kept synchronized.

After creating the MAPS project in MAPS-1Engineer, you need to open the MAPS Designer to complete the final configuration, such as:

- Performing the **Sync Tags** command to create the SCADA configuration of each Plant Area in the associated Adroit Agent Server.
- Performing the **Build PLC Project** command to create the PLC program ASCII file and opening the GX IEC Developer/GX Works 2 for each PLC.

- Creating the SCADA graphics and the necessary navigation for the Operator-view of this project.

8. MAPS DESIGNER

By now it should be clear that the MAPS Designer is the primary method of configuring the MAPS Server and each MAPS project that you create.

Now we need to briefly introduce you to the architecture of the MAPS Server and its two Clients, the MAPS Designer and the MAPS Operator:

The MAPS Server is a collection of datasources. Some of these datasources are internal and manage the user security of MAPS and its roaming user profiles. Other datasources are external and allow the MAPS Server to connect to databases and to create MAPS projects.

Each MAPS project is a datasource that contains a collection of “graphic forms”. These graphic forms create the user interface of the MAPS project and allow your operators to view and interact (control) the resultant process site.

The MAPS Server has the following two client applications that it communicates to:

- The MAPS Designer, which configures the MAPS Server and its datasources. This is called the Designer because it can create the graphic forms.
- The MAPS Operator, which is used to view and interact with the configured MAPS projects. This is called the Operator because it can operate the created graphic forms.

When you launch the MAPS Designer, the default layout will look like this:

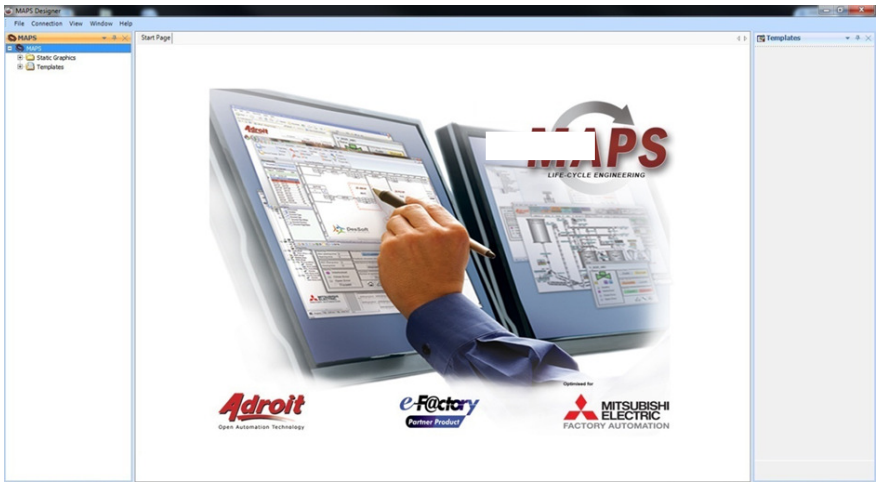


Figure 17 MAPS Designer

Fortunately, this default layout hides the complexity of the MAPS Designer, allowing you to get on with the most important job – namely designing your MAPS projects!

The **MAPS** window on the left shows:

- the hierarchical levels of each MAPS project i.e. Plant Area's, PLC's, Unit's and Equipment.
- the library of all the static graphics that gets shipped with MAPS, which can be used to complete the SCADA graphics – as explained later.
-

NOTE: When completing the SCADA graphics, you can use the **Templates** window, on the right, to create your own custom set (library) of generally used **Static Graphics**.

TIP: You can resize the graphical representations of the MAPS templates (equipment items), by selecting the required image and dragging its size handles. By default, the resizing of the equipment name text is disabled, but this can be enabled by setting the **TextScaling** property of the **TextBox** control to TRUE.

Right click on the MAPS root node of the MAPS window on the left, which is actually a datasource, to display the following menu of options:

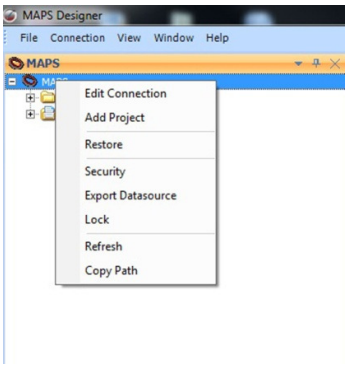


Figure 18 MAPS datasource Options

- **Edit Connection**: To specify different MAPS databases, usually there is only one MAPS database.
- **Add Project**: To launch the MAPS project wizard to create a MAPS project.
- **Restore**: To restore a previously backed up MAPS project from the created .ZIP file. See the MAPS project's **Backup** option below, for more information on backing up a MAPS project.
- **Security**: To specify which users and/or user groups have access to read, write and remove data of the MAPS datasource. You can also specify which users can configure these access rights for the MAPS datasource.
- **Refresh**: To display any new changes made to the MAPS datasource. This is particularly useful when more than one person is simultaneously working on the same MAPS datasource.
-

NOTE: Ignore the **Export Datasource** and **Lock** options, which are standard features that apply to all datasources. You can also ignore the **Copy Path** option, which is a standard feature of EVERY level of the MAPS datasource. This obtains the fully qualified path of the current item in a datasource, which is required when performing advanced configuration of MAPS.

Once you have created a MAPS project for your process Site, it appears in the MAPS datasource (window) and is identified by this icon: . *(See the **MAPS Quick Start** document for how to create a MAPS project).*

8.1 MAPS Project (Site) Options

Right click on a MAPS project , to display the following menu of MAPS project (process Site) options:

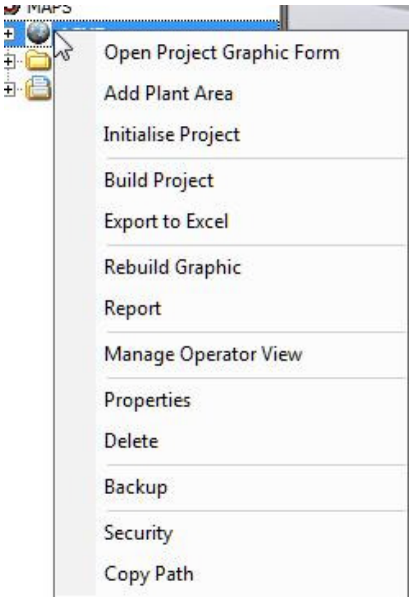


Figure 19 MAPS project options

- **Open project graphic form:** To display the graphic form that displays the different plant areas. The graphic form is created by default with the different plant areas that you have specified for your MAPS project.

  This graphic form can be designed and configured to the specification you want.

  IMPORTANT: You will LOSE any configuration made to this graphic form, if you select ANY **Rebuild All Graphics** option or the MAPS project's **Rebuild Graphic** option. These options will OVERWRITE your current project graphic form with the default graphic form.

- **Add Plant Area:** To add and/or configure and populate a new plant Area for the process Site that this MAPS project represents.

- **Initialise Project:** This option is only necessary when you use the MAPS-1Engineer to create your MAPS project. In this case this option fetches the MAPS project from MAPS-1Engineer.

- **Build Project:** This option displays the **Build Project** dialog that contains the following three options, as separately-configurable checkboxes, used when creating MAPS projects:

  - **Initialise Project:** This option is only necessary when you use the MAPS-1Engineer to create your MAPS project. In this case this option fetches the MAPS project from MAPS-1Engineer.

  - **Build Operator View:** This builds the MAPS navigation structure automatically according to your plant Areas and their Units.
    This is especially useful if you create Custom graphic forms as this option automatically

includes these Custom graphic forms in the navigational menus of the Operator view graphic form.

TIP: You can also use the **Manage Operator View** right click menu option of the MAPS Project to specify which graphic forms to display in the Operator view.

- **Rebuild All Graphics:** To (overwrite) restore ALL the graphic forms created automatically for this ENTIRE MAPS project, to their original default configuration.

  WARNING: Use this option with care, as it will cause you to LOSE ALL CONFIGURATION made to the default graphic forms of your MAPS project. Typically this option is ONLY required after initially creating your MAPS project.

- **Export to Excel:** To export this MAPS project to Microsoft Excel for bulk-editing. After editing this project, you can re-import it using the **Import from Excel** right click option provide the main MAPS root node.

  NOTE: When importing an edited project, you either have the option of creating a new project or overwriting an existing one.

  The main purpose of this Export to / Import from Excel functionality is to enable users, who used to MAPS project wizard to create the initial MAPS project, to bulk configure their MAPS project.

  For instance, when creating a plant with 100 conveyors, it may be useful to add one conveyor using the MAPS project wizard and then export the project and bulk configure the other 99 conveyors in Excel and then import this modified project.

  NOTE: You need MS Excel 2003 or later installed before you can use this function.

  TIP: We recommend that you first use the MAPS Project wizard to create at least one Plant Areas and PLCs and Unit and Equipment – to understand the required syntax and requirements for the fields on each of the worksheets of this Excel file.

  NOTE: If you make mistakes during the editing process, the Excel spreadsheet is analyzed before the importing occurs and detailed feedback is provided on all mistakes that have been made.

- **Rebuild Graphic:** To (overwrite) restore the project graphic form to its original or default configuration. This is useful if this form becomes corrupted or is accidentally deleted.

- **Report:** To create a report on the current MAPS project. This report includes the following: the project hierarchy; the PLC devices; the different types of equipment and their quantities; and each piece of equipment with their assigned SCADA to PLC addressing.

  There are 3 options to choose:

  - **Preview**: to display this report in PDF format.
  - **Print**: to print this report to any printer configured on the computer.
  - **Edit**: to edit this report in the provided report editor so that it complies with your user specifications.

- **Manage Operator View:** To specify which graphic forms are displayed in the Operator view. In other words to select which toolbar buttons are created during the **Build Operator View** process. Typically this is required if you create Custom graphic forms for your project and need to hide the default graphic forms automatically generated by the project.

- **Properties:** To display and/or edit the following MAPS project-specific settings:

  - the following user-defined paths: the project path (which determines the location of the PLC projects); the report paths (where the project and PLC reports should be stored) and/or where the Documents created for this project are stored.
  - the report templates that customize the default Project and PLC reports.
  - the graphic form that the Operator view displays by default. Typically the Operator view graphic form displays the plant area graphic form. But you can specify a unit or Custom graphic form instead.
  - the default screen resolution (screen size) of all the graphic forms of this project.
  - the **Show Equipment Title** checkbox, which displays (default is checked) or hides the names of your equipment on the graphic forms.
    Typically you will hide these equipment names to unclutter the graphic forms or when these names only serve to confuse your operators.

- **Delete:** To delete this entire MAPS project.

- **Backup:** To create a copy of your MAPS project and a compressed .ZIP file, whose file name is the date and project name, e.g. 6-14-2011_ACME.zip. Both this ZIP file and the copy of your project, is saved to the MAPS project path that you specified when creating the project. Typically this is C:\MAPS\Projects\YourProjectName.

- **Security:** To specify which users and user groups have access to read, write and remove items of this MAPS project.

Noteworthy MAPS Project (Site) options: **Report** and **Properties** and possibly **Export to Excel** once the MAPS Project is created.

8.2 Plant Area Options

According to the hierarchical structure of the MAPS project, the next level is the Plant (process) Area  , which when right clicked displays the following options:

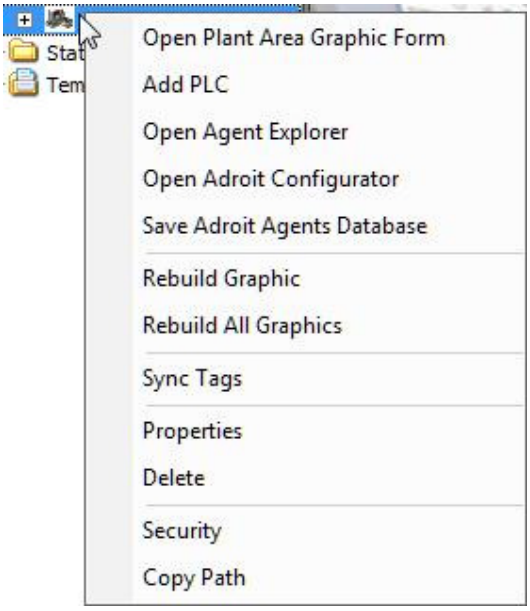


Figure 20 MAPS Plant Area options

- **Open plant area graphic form:** To display the graphic form that shows the different PLCs configured for this plant area. The graphic form is created by default.

  This graphic form can be designed and configured to the specification you want.

  IMPORTANT: You will LOSE any configuration made to this graphic form, if you select the project's or plant area's **Rebuild All Graphics** option or the plant area's **Rebuild Graphic** option. These options will OVERWRITE your current plant area graphic form with the default graphic form.

- **Add PLC:** To add and/or configure and populate a new PLC for this plant area.

  Since each plant area has an associated Adroit Agent Server which contains the SCADA tags or agents of the equipment in this plant area. The following plant area options are provided

- **Open Agent Explorer:** To launch an Adroit Agent Server diagnostic and configuration tool, called the **Agent Explorer**.

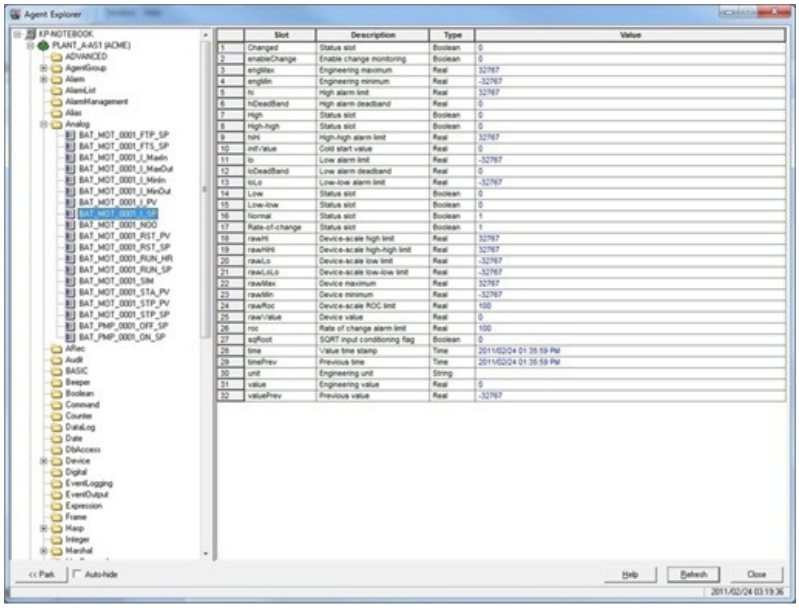


Figure 21 Agent Explorer window

In the **Agent Explorer** window you can create, delete, scan, alarm, edit and log additional Adroit tags that you have created.

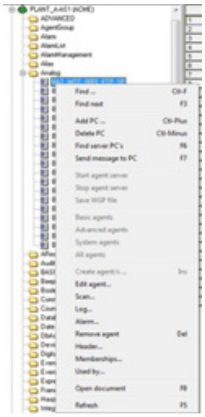


Figure 22 Agent Explorer options

- **Open Adroit Configurator:** To launch the legacy configuration tool of the Adroit Agent Server, called the Adroit Configurator. The Adroit Configurator provides the same functionality as the Agent DB Explorer and is provided for existing Adroit SCADA users.

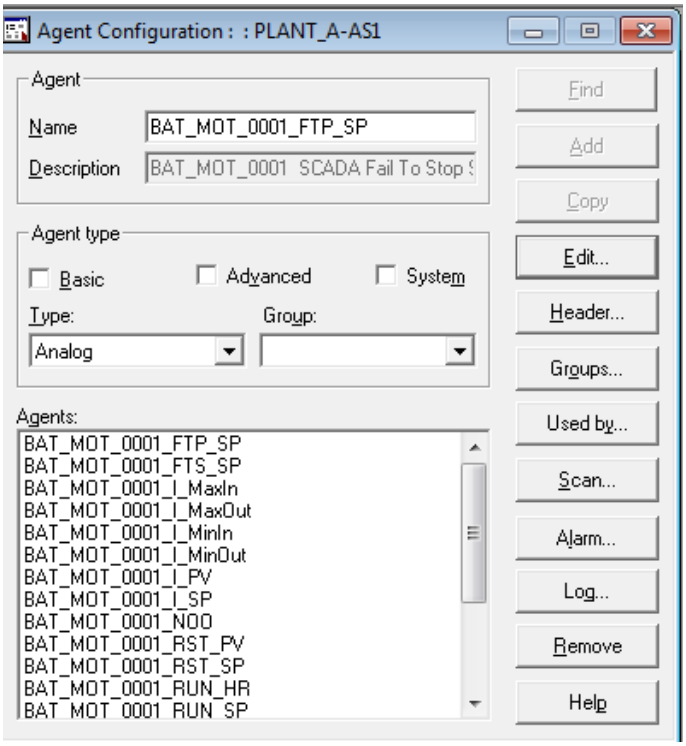


Figure 23 Adroit Agent Configurator

- **Save Adroit Agents Database:** To save the Adroit Server database (.WGP file), which is necessary whenever you make changes the Adroit Agent Server.

- **Rebuild Graphic:** To (overwrite) restore the Plant Area graphic form to its original or default configuration.. This is useful if this form becomes corrupted or is accidentally deleted.

- **Rebuild All Graphics:** To (overwrite) restore ALL the graphic forms created automatically for this plant Area and its PLCs and their Units, to their original default configuration.

  WARNING: Use this option with care, as it will cause you to LOSE ALL CONFIGURATION made to these default graphic forms of your MAPS project. Typically this option is ONLY required after initially creating your MAPS project.

- **Sync Tags:** To synchronise the tags between the Adroit Agent Server and the MAPS project database. This launches the **Sync Tags** wizard, which lists all the tag changes (discrepancies) between the MAPS project database and the Adroit Agent Server.

  This **Sync Tags** wizard displays the names of the affected tags and their type and whether the Adroit Agent Server or MAPS project database needs to be updated. Simply click **Finish** to update these tags.

- **Properties:** To change the MAPS Server and/or the plant area code for any new equipment that is added.

  Note: The Plant Area Code is an OPTIONAL unique alphanumeric code (3 characters) that is prefixed to tag names to ensure unique and identifiable tag names in each plant area of your project.
- **Delete:** To delete this plant area.

- **Security:** To specify which users and user groups have access to read, write and remove items of this plant area.

Noteworthy Plant Area options: **Sync Tags**, **Save Adroit Agents Database** and **Open Agent Explorer**.

8.3 PLC Options

According to the hierarchical structure of the MAPS project, the next level is the PLC , which when right clicked displays the following options:

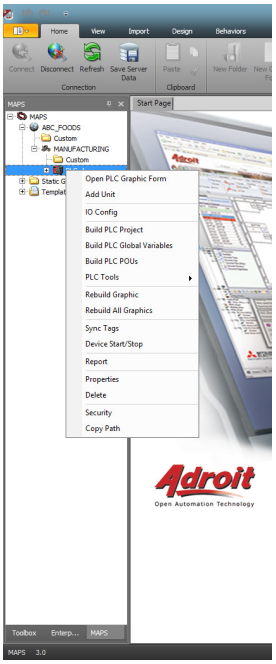


Figure 24 PLC options

- **Open PLC graphic form**: To display the graphic form that depicts this PLC. By default, this graphic form is not displayed in the MAPS Operator.

- **Add Unit:** To add a working unit assigned to the PLC. For an example, you could differentiate MCCs or a Crusher that consists of multiple instrumentation and/or electrical equipment.

- **IO Config:** To view and/or change the addresses of the IO signals of ALL the equipment assigned to this PLC. This **IO Configuration** wizard lists the configured IO for this PLC, providing the name of the associated equipment, template and signal and its description and addressing.

- **Build PLC Project:** To build your MAPS project function blocks, which are determined by the MAPS templates you associated to each of your equipment. This opens the GX IEC Developer and creates a library for each Unit name in this PLC.

  NOTE: In order to run this option, you will need GX IEC Developer or GX Works 2 to be installed on your computer.

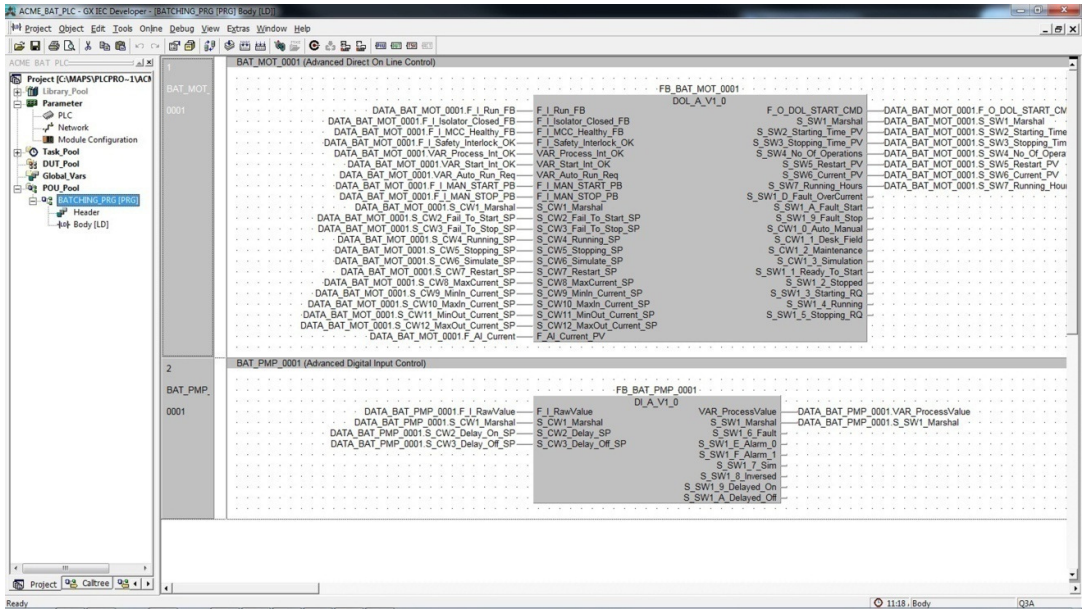


Figure 25 GX IEC Developer displaying a Function Block

- **Build PLC Global Variables:** To create the global variables of this PLC project in the ASCII file format.

- **Build PLC POUs:** To build the POUs (Program Organisation Units) into an ASCII (.asc) file that you can load into your PLC via GX IEC Developer or GX Works 2. In other words this creates the PLC program containing the Function Blocks of all the equipment controlled by this PLC.

- **PLC Tools:** To open the Mitsubishi GX IEC Developer or GX Works 2 diagnostics tools for this PLC project, from the MAPS Designer to make fault finding easier. The following PLC tools are provide:

  NOTE**:** ONLY the first two tools can be used when the PLC is offline.

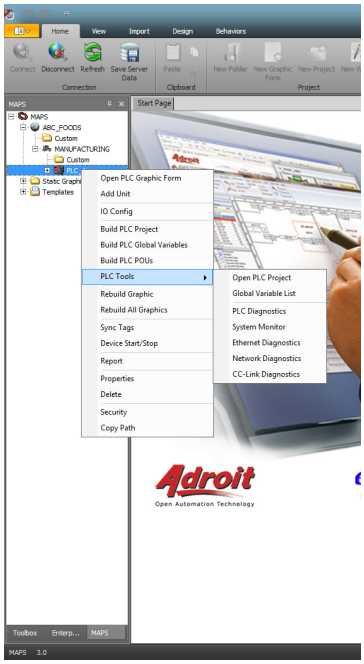


Figure 26 PLC Tools

- **Open PLC project:** To display the GX IEC Developer or GX Works 2 project for this PLC, so that its Function Blocks can be edited.
- **Global Variable List:** To display the global variable list of the GX IEC Developer or GX Works 2 project for this PLC.
- **PLC Diagnostics:** To display the GX IEC Developer or GX Works 2 **PLC Diagnostics** utility for this PLC.

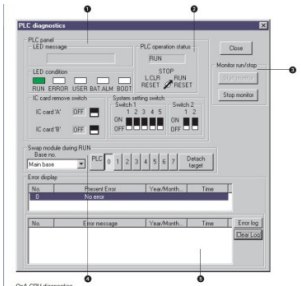


Figure 27 GX IEC Developer PLC Diagnostics

- **System Monitor:** To display the GX IEC Developer **System Monitor** utility, which provides comprehensive information about the entire PLC system.

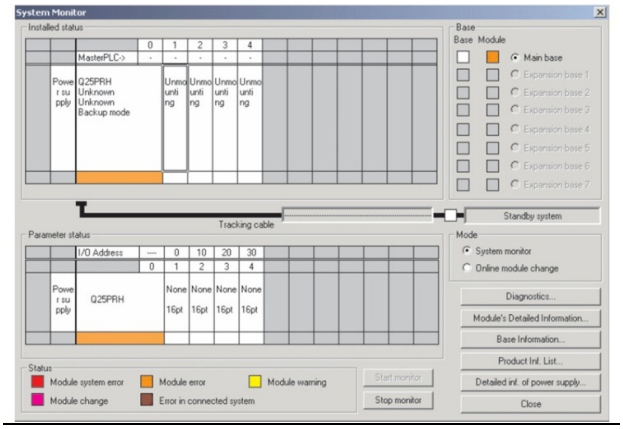
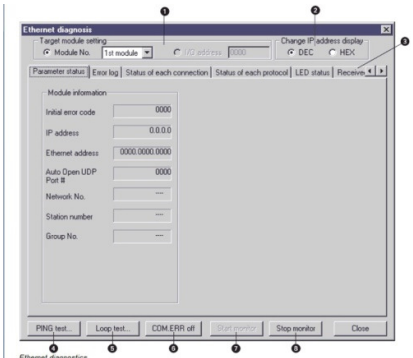


Figure 28 GX IEC Developer System Monitor

- **Ethernet Diagnostics:** To launch the GX IEC Developer or GX Works 2 **Ethernet Diagnostics** utility for this PLC.

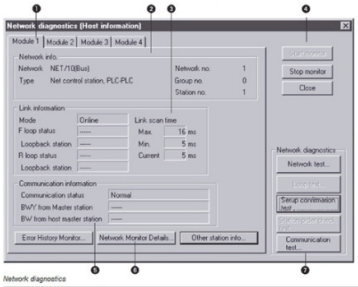


Ethernet diagnostics

Item	Description
❶	**Target module setting** Here you select the Ethernet module to be checked. The Q series modules No. 1 – 4 can be selected. A or QnA series modules are selected by their I/O address.
❷	**Change IP address display** Here the display of the IP address can be toggled between decimal or hexadecimal format.
❸	**Tabs for Ethernet information** Here different information types for the Ethernet modules are displayed.
❹	**PING test** Tests an Ethernet module that has completed its initialization or checks for any existing IP address. The PING test can either be executed via an Ethernet board or via a direct connection to the PLC CPU.
❺	**Loop test** This function is intended for Ethernet modules that are compatible with the Q series function version B or higher. A loop instruction tests whether all modules under a specified network number or station number have completed their initialization. If this test is executed for Ethernet modules that are compatible with the Q series function version A the response can not be evaluated and is processed as not responding. The loop test can either be executed via an Ethernet board or via a direct connection to the PLC CPU.
❻	**COM. ERR. off** Turns off the communications error LED.
❼	**Start monitor** Starts the Ethernet diagnostics.
❽	**Stop monitor** Stops the Ethernet diagnostics.

Figure 29 GX IEC Developer Ethernet Diagnostics

- **Network Diagnostics**: To launch the GX IEC Developer or GX Works 2 **Network Diagnostics** utility for this PLC.



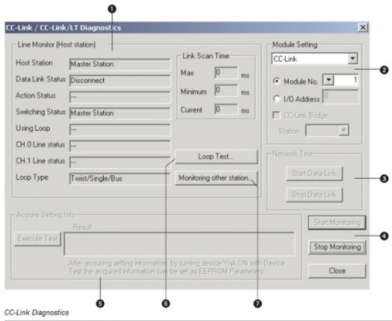
Network diagnostics

Item	Description
❶	Tabs for link modules Select the tab for the link module for displaying the diagnostics results (AnN or AnA CPUs only support 2 modules).
❷	Network information Shows information on the network the selected target host station belongs to (for MELSECNET (II) the network number and group address are not displayed).
❸	Link information Shows the network status.
❹	Monitoring The **Start monitor** button starts monitoring. In RUN mode the display will be updated. The **Stop monitor** button stops monitoring.
❺	Communication information Shows the communications status of the selected network (for MELSECNET/10 only the communications status is displayed).
❻	Error History Monitor (see below) Network Monitor Details (see below) Other station information (see below)
❼	Network diagnostics (see below) Network test Setup confirmation test Station order check test Communication test

Network diagnostics items

Figure 30 GX IEC Developer Network Diagnostics

- **CC-Link Diagnostics**: To launch the GX IEC Developer or GX Works 2 **CC-Link Diagnostics** utility for this PLC. This utility monitors the network information of each station and tests the network status.



CC-Link Diagnostics

Item	Description
❶	**Line Monitor (Host station)** Lists all connection relevant CC-Link information. For details on the indication of special relays (SB) and special registers (SW) refer to: **Loop test:** See section below **Monitoring other station:** See section below
❷	**Module setting** (Q series only): Specify the module the CC-Link diagnostics have to be executed for. Before executing make sure that your Q CPU and QJ61BT11 are of function version B or higher.
❸	**Network test** The data link is started or stopped for the specified CC-Link module.
❹	**Monitor start/stop** The monitoring of the host station is started or stopped.
❺	**Acquire the setting information** The setting information of the CC-Link module is acquired for the CC-Link status. After execution the acquired setting information can be set as EEPROM parameters by turning ON the device YnA via the **Device Test**.
❻	**Loop test:** See section below
❼	**Monitoring other station:** See section below

CC-Link Diagnostics items

Figure 31 GX IEC Developer CC-Link Diagnostics

- **Rebuild Graphic:** To (overwrite) restore the PLC graphic form to its original or default configuration. This is useful if this form becomes corrupted or is accidentally deleted.

- **Rebuild All Graphics:** To (overwrite) restore ALL the graphic forms created automatically for this PLC and its Units, to their original default configuration.

  WARNING: Use this option with care, as it will cause you to LOSE ALL CONFIGURATION made to the default graphic forms of your MAPS project. Typically this option is ONLY required after initially creating your MAPS project.

- **Sync Tags:** To ONLY synchronise the tags of the equipment in this PLC, between the Adroit Agent Server and the MAPS project database. This launches the **Sync Tags**

wizard, which lists all the tag changes (discrepancies) between the MAPS project database and the Adroit Agent Server.

This **Sync Tags** wizard displays the names of the affected tags and their type and whether the Adroit Agent Server or MAPS project database needs to be updated. Simply click **Finish** to update these tags.

- **Device Start/Stop:** To start or stop the PLC device in Adroit Agent Server. This ONLY affects the communication process between Adroit and the PLC and NOT the status of the PLC in the field.

- **Report:** To create a detailed report of this PLC and its IO configuration, which includes: the different types of IO; the associated Equipment name, addressing and a description of each IO signal does.

  There are 3 options to choose:

  - **Preview**: to display this report in PDF format.
  - **Print**: to print this report to any printer configured on the computer.
  - **Edit**: to edit this report in the provided report editor so that it complies with your user specifications.

- **Properties:** To specify the name of the associated Adroit device; to allocate the free IO when adding or removing equipment and to specify the correct start and end addresses for each IO type.

- **Delete:** To delete the currently selected PLC from the MAPS project.

- **Security:** To specify which users and user groups have access to read, write and remove items of this PLC.
  Noteworthy PLC options: the **PLC Tools** menu provides diagnostics that can be very useful for any engineer doing fault finding.

8.4 Unit Options

According to the hierarchical structure of the MAPS project, the next level is the Unit  , which when right clicked displays the following options:

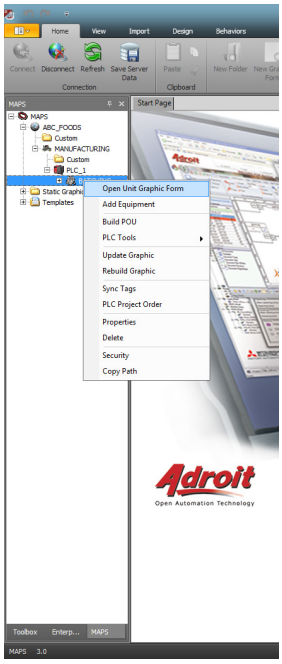


Figure 32 Unit Options

- **Open unit graphic form:** To display the graphic form that displays all you specified equipment. This is the graphic form that your operators will use to control and monitor your plant.

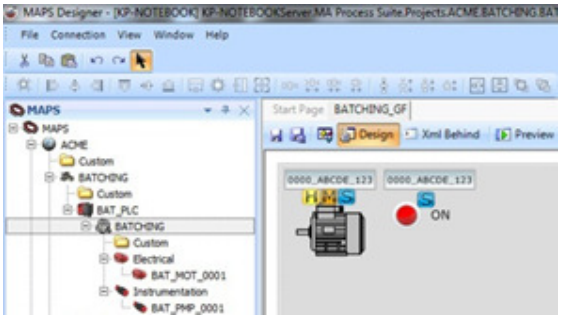


Figure 33 Default Unit graphic form with the default layout of its equipment

You will typically construct the graphical representation of your unit's process on this graphic by moving the equipment into the correct position and adding the relevant static graphics.

IMPORTANT: If you select any **Rebuild All Graphics** option or the **Rebuild Graphic** option for this unit, ALL the existing graphics will be OVERWRITTEN with the default graphics, which ONLY displays the added equipment.

- **Add Equipment:** To add more equipment to this unit. If you have done your planning correctly this option should NOT be required.

NOTE: After manually adding equipment, you need to perform the **Build PLC Project** option to add the new function blocks to the PLC program and **Sync Tags** to add the necessary SCADA tags to the Adroit Agent Server and **Update Graphic** option to add the new equipment graphics to this graphic form.

- **Build POU:** To build the POU (Program Organisation Unit) of this unit into an ASCII (.asc) file that you can load into your PLC program via GX IEC Developer or GX Works 2.

- **PLC Tools:** To use the **Show POU in PLC Project** option to open the POU of this unit in GX IEC Developer or GX Works 2.

- **Update Graphic:** To add new equipment to the unit graphic form while keeping the existing equipment and/or static graphics untouched.

  NOTE**:** This is the recommended option for adding new equipment, once you have built the graphical representation of your unit's process on this graphic form, using static shapes and other tools.

- **Rebuild Graphic:** To (overwrite) restore the Unit graphic form to its original or default configuration, by removing all static graphics and other tools on the graphic form and rearranging your equipment in the default layout. This is ONLY useful if this form becomes corrupted or is accidentally deleted.

- **Sync Tags:** To ONLY synchronise the tags of the equipment in this Unit, between the Adroit Agent Server and the MAPS project database. This launches the **Sync Tags** wizard, which lists all the tag changes (discrepancies) between the MAPS project database and the Adroit Agent Server.
  This **Sync Tags** wizard displays the names of the affected tags and their type and whether the Adroit Agent Server or MAPS project database needs to be updated. Simply click **Finish** to update these tags.

- **PLC Project Order**: To change the default order of the function blocks in this Unit. For instance, to group related function blocks together so that they are easier to locate in the generated PLC program.

  TIP: You should typically perform this operation BEFORE building your PLC project for this unit.

- **Properties:** To view or change the description of this Unit.

- **Delete:** To delete the currently selected Unit from the MAPS project.

- **Security:** To specify which users and user groups have access to read, write and remove items of this Unit.

Noteworthy Unit options: **Open unit graphic form**, **PLC Project Order**, **Update Graphic** and **Show POU in PLC Project**.

8.5 Equipment Options

According to the hierarchical structure of the MAPS project, the next level are the items of equipment, which are either Electrical or Instrumentation. When an item of equipment is right clicked, the following options are displayed:

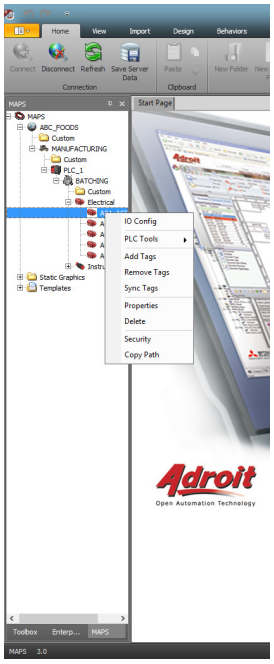


Figure 34 Equipment Options

- **IO Config**: To view and/or change the addresses of the various IO signals assigned to this item of equipment by the associated MAPS template. This list describes the IO and displays the PLC address assigned to each IO.

- **PLC Tools**: To use the **Show Equipment in PLC Project** option to open the function block of this item of equipment, in the GX IEC Developer or GX Works 2 for diagnostics purposes.
- **Add Tags**: To add the SCADA tags of this item of equipment to the Adroit Agent Server. This can be performed after adding this item of equipment to an existing MAPS project.

- **Remove Tags**: To remove SCADA tags associated of this item of equipment from the Adroit Agent Server. This should be performed before you delete this item of equipment from the MAPS project.

- **Sync Tags:** To ONLY synchronise the tags of this item of equipment, between the Adroit Agent Server and the MAPS project database. This launches the **Sync Tags** wizard, which lists all the tag changes (discrepancies) between the MAPS project database and the Adroit Agent Server.

  This **Sync Tags** wizard displays the names of the affected tags and their type and whether the Adroit Agent Server or MAPS project database needs to be updated. Simply click **Finish** to update these tags.

- **Properties**: To change the SCADA graphic used to represent this item of equipment in the Unit graphic form.

- **Delete**: This will delete the currently selected item of equipment from the MAPS project.

- **Security**: To specify which users and user groups have access to view, modify and remove this item of equipment.

Noteworthy Equipment option: **Show Equipment in PLC Project**.

8.6 Custom Folders

Each level of the MAPS project architecture provides a **Custom** folder. You can create your own custom graphic forms in these folders. After creating a Custom graphic form, you need to right click right-clicking the project node and select **Build Project** and in the dialog ONLY check the **Build Operator View** checkbox and click **Finish**.

This includes this graphic form in the navigational menus of the main Operator view graphic form for this MAPS project, provided that you have NOT unchecked this graphic form in the **Manage Operator View** MAPS project right click option.

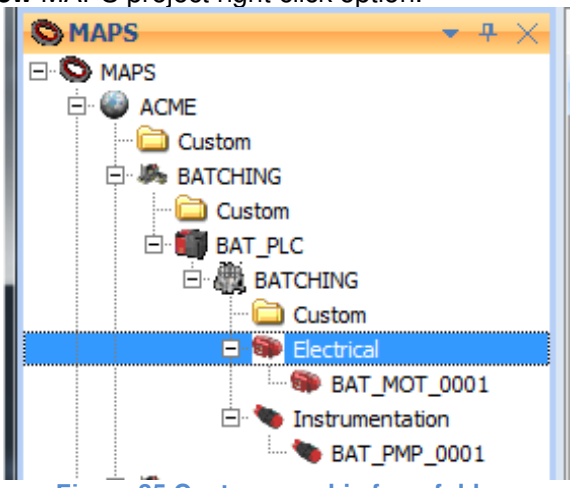


Figure 35 Custom graphic form folders

NOTE: Custom graphic forms are unaffected by the **Rebuild Graphic** and **Rebuild All Graphics** commands.

8.7 Operator View – MAPS Project Graphic Form

The Operator view graphic form is the main or central graphic form of a MAPS project. In other words, this is the graphic form that your operators use, in the MAPS Operator, to view and control your process site.

NOTE: By default the Operator view graphic form displays the plant area graphic form. You can change the graphic form that the Operator view initially displays by configuring the **Default Operator GF** property of the MAPS project (right click the project and select **Properties**).

The Operator view graphic form provides an automatically generated navigational structure of menus, with buttons linking together both the default and Custom graphic forms of the plant areas, PLCs and units (displaying the equipment) defined in your MAPS project. Your operators can navigate between these graphic forms by using these buttons.

When viewing the unit graphic forms that display your equipment, click on the graphical representation of an item of equipment, to display its intelligent faceplate.

NOTE: Custom graphic forms are ONLY added to the navigational menus, AFTER adding them to your MAPS project, by right clicking the project node and selecting the **Build Project** option and in the dialog ONLY check the **Build Operator View** checkbox and click **Finish**.

NOTE: You can use the **Manage Operator View** MAPS project right click option to specify exactly which graphic forms you want to display in the Operator view graphic forms, by checking or unchecking their checkboxes in the **Manage Operator View** dialog.
The Operator view graphic form is created in the root of your MAPS Project folder, in the MAPS window. This graphic form is created along with the other default graphic forms of the MAPS project.

By default this Operator view graphic form appears as follows:

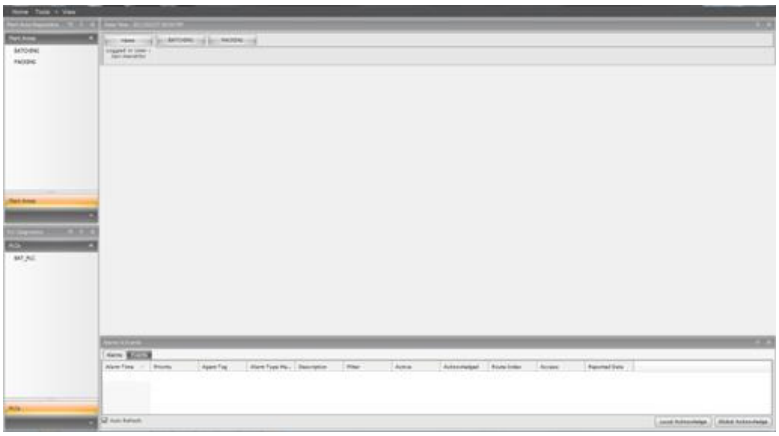


Figure 36 Default view of the Operator view graphic form

This Operator view graphic form also provides the following menus:

The **View** menu that allows you to select which components (windows) you want to display or hide, by default, to increase the available viewing area for more important components.

The **Tools** menu, which allows you to save a 'workspace' for each operator to save the **View** menu settings, the positions of the displayed components and which component is opened by default for the current operator.

8.8 Default Folders of the MAPS Window

The **Static Graphics** folder of the MAPS window contains a library of static graphical shapes that you can use to design your unit graphic forms to graphically represent your process.

The **Templates** folder of the MAPS window contains a library of the available Electrical and Instrumentation MAPS templates that you can associate to your equipment.

If necessary, you can add equipment to an existing MAPS project, by dragging the required MAPS template directly from the **Templates** folder into the appropriate equipment category of an existing MAPS project, as follows:

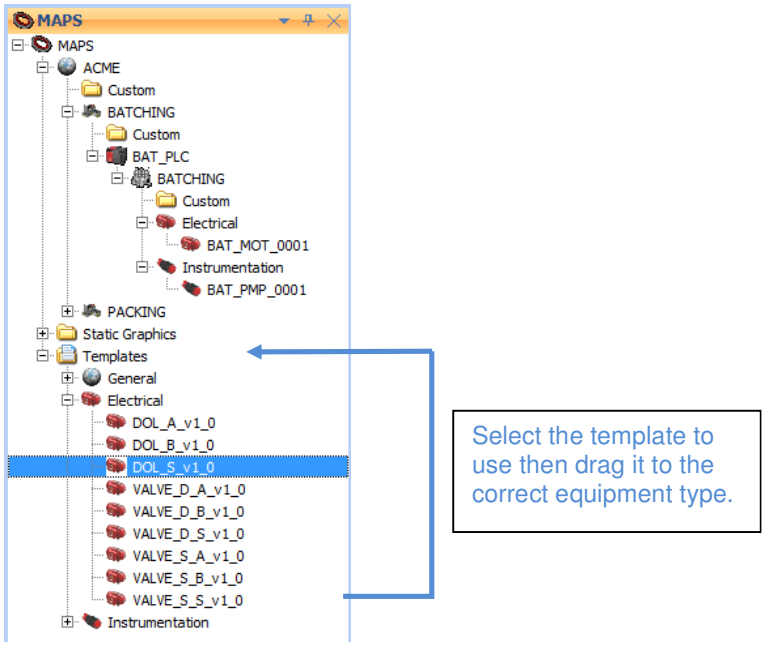


Figure 37 Dragging equipment directly from the Templates folder to a MAPS project

9. MAPS OPERATOR

After configuring the MAPS project, open the MAPS Operator to display the created Operator view graphic form.

Like the MAPS Designer, before the MAPS Operator can be opened, you need to log in.

The specified username applies the configured security policies and settings to the MAPS Operator environment. For instance, if you configure a workspace for this username (using the **Tools** menu of the Operator view graphic form) then the specified component is opened by default and the **View** menu is already configured.

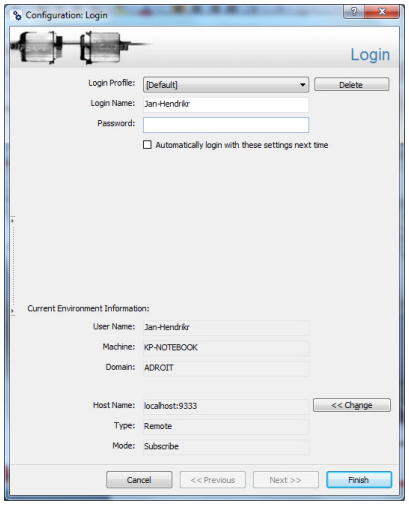


Figure 38 MAPS Operator log in screen

NOTE: If you do NOT require this added security, then you can specify an automatic login to prevent this login screen from appearing again.

Be default, the Operator view graphic form of your MAPS project is displayed, as follows:

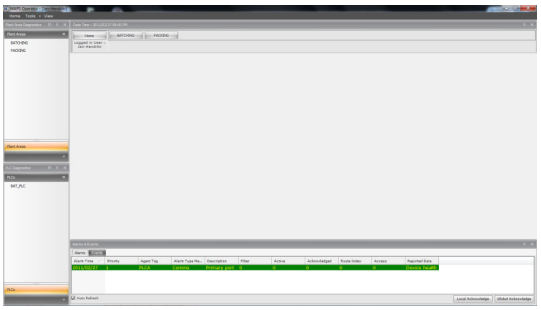


Figure 39 MAPS Operator interface

10. REDUNDANCY (HOT STANDY)

Redundancy or the ability to improve the availability of the MAPS solution can be achieved in the following two ways:

- Firstly, you can implement Adroit Active Clustering to enable the high availability of the SCADA and the SCADA to PLC communication.
- Secondly, you can implement MAPS Server clustering to enable the high availability of the MAPS Server and load balancing among the MAPS Operators and MAPS Designers that connect to this MAPS Server cluster.

10.1 Adroit Active Clustering

The Adroit Active Cluster is essentially a set of TWO Adroit Agent Servers (a Master and a Standby) running a replicated database (WGP file) on the same project. This provides Adroit-to-PLC redundancy by of this component of the MAPS solution.

The general idea of clustering Adroit Agent Servers for MAPS is that the master server services the scanning of the IO to/from the PLCs and the changes to its agents, while the standby server replicates the master server. If the master server or machine fails, then the standby server immediately takes over as master and the PLCs and agents automatically switch to this new server.

NOTE: A clustered Agent Server can be networked with other normal (non-clustered) servers.

You use the **MAPS Config** utility to configure an Adroit Active Cluster, as follows:

- In the **Agent Server** configuration, the only difference between the two Adroit Agent Servers should be the Agent Server Name.

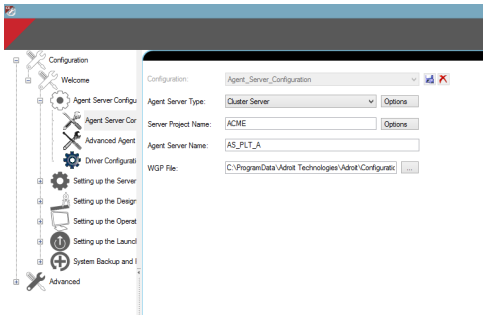


Figure 40 Configuring an Adroit Active Cluster in MAPS Config Editor

- In the **Drivers Configuration** selection, ensure that both Adroit Agent Servers have the same Mitsubishi Q Series device/s configured.

You also need to edit the Adroit datasource in the MAPS Designer and change datasource **Type** to **Redundant** and specify the names of BOTH Agent Servers.

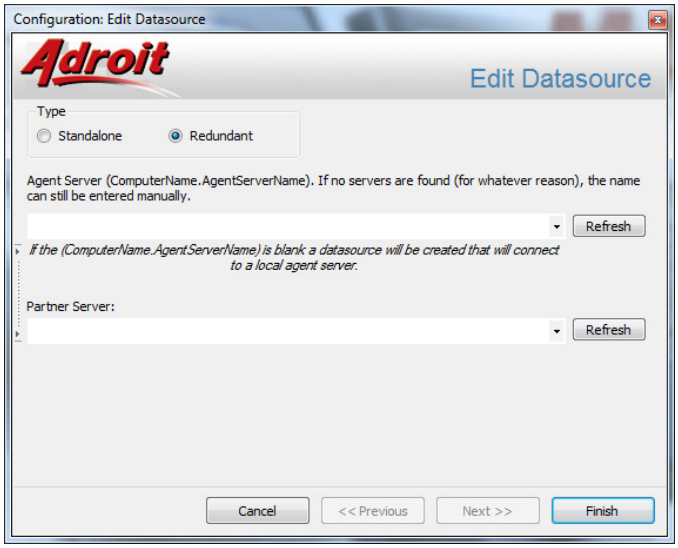


Figure 41 Configuring an Adroit Active Cluster in MAPS Designer

10.2 Clustering MAPS Servers

MAPS Servers can be clustered to ensure their availability and to provide both load balancing for their connected MAPS Operators. ANY number of Servers can belong to the same Cluster, in which case, they are known as cluster partners. In other words, all the Servers within a Cluster can handle their combined workload evenly and provide continued operation in the event that one or more fail.

This combined workload is generated by their connected MAPS Operators that are made aware of this cluster. This workload is shared by the number of concurrent connections that can be made by these Operators to each of the cluster partners.

For instance, if one MAPS Server has been licensed to have 10 client connections and it is placed in a cluster with a MAPS Server that only has with 5 connections, these two servers are only able to share the workload until the MAPS Server with 5 connections has been fully utilized. Thereafter, all new connections would be made to the remaining MAPS Server with spare connections. Furthermore if the MAPS Server with 10 licensed connections fails, only 5 MAPS Operators will be able to remain connected.

Therefore, it is recommended that there are enough connections on any one Server to satisfy all the Operator client connection needs, irrespective of how many Servers are within the cluster. However, the greater the number of Servers within the cluster the greater the assurance exists of a fail-safe operation.

Each Server uses UDP broadcasts to inform Clients of its availability and load. The load of each Server is determined by the number of Clients that are currently connected to it.

Each cluster aware Operator maintains a list of Servers for ALL the clusters that it connects to. The list is periodically updated by the Operator, which obtains the availability and load of these Servers from their broadcasts. Cluster aware Operators automatically switch over to the Server with the lightest load.

You use the **MAPS Config Editor** utility to configure a MAPS Cluster, as follows:

- To create a redundant MAPS Server (to make it a cluster partner), specify the required cluster name, in the **General** page of the **Setting up the Server** settings for this MAPS Server.

- To make a MAPS Operator aware of a specific MAPS Server cluster, configure the **Cluster Settings** page of the **Setting up the Operator** settings for this MAPS Operator.

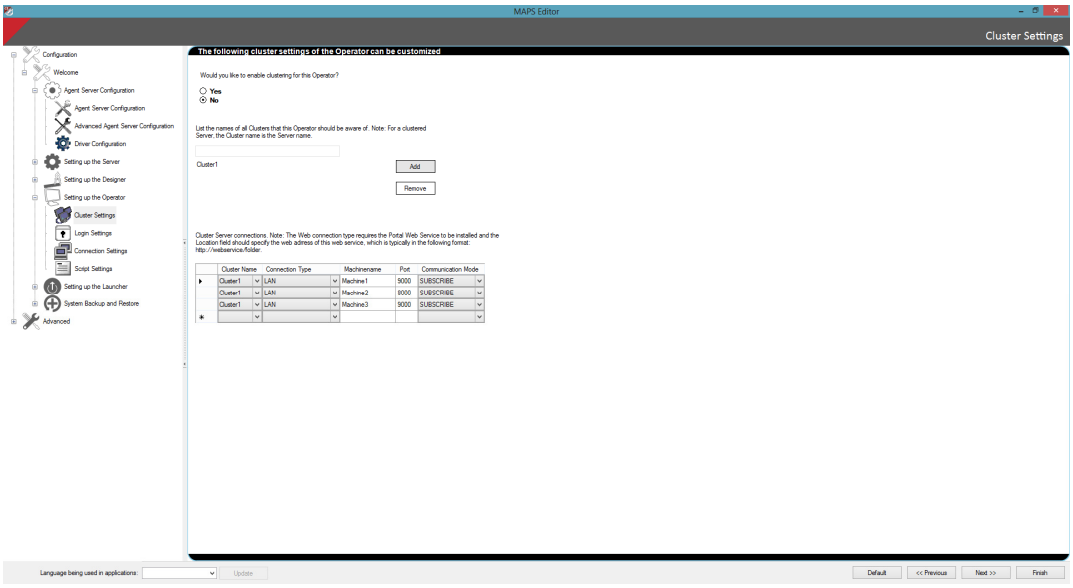


Figure 42 MAPS Operator Cluster settings

11. SECURITY

Since MAPS is essentially used to operate and control a process, it is critical that the different levels of users have different levels of access. For example, to prevent Operator-level users from configuring process set-points.

Security in MAPS is user-centric and operates on top of the traditional Windows operating system security, using a configurable sub-set of the existing users and groups on each MAPS Server computer, known as the "allowed" users and groups. For instance, when a client (MAPS Designer and Operator) is launched, it is necessary to login to a Server and only a user that is ether an allowed user or a member of an allowed group, on this MAPS Server is able to log into it.

The following diagram describes the default (recommended) configuration of security in MAPS, showing the login or Windows groups of users and their different access or security levels:

Operator Actions		Security Levels				
		View Only. No Control, Operation or Data entry.	Controller Set point Input	Controller SP HLM/LLM	Controller parameters (Gain, Integral)	User administration
			Controller Man select / Man output chg	Controller MV HLM/LLM	Analog Status alarm values (HH, H, L, LL)	
			Device / Sequence start/stop		Maintenance functions (maint alarms, Reset times..)	
Login Groups	Guest	x				
	Operator	x	x			
	Technician	x	x	x	x	
	Engineer	x	x	x	x	x
	Metallurgist	x	x	x		
	Supervisor	x	x		x	
	Administrator	x	x	x	x	x

Figure 43 MAPS default security configuration

Every MAPS user needs to be assigned to the relevant Windows user group and requires a username and password.

12. MAPS INTERNET CAPABILITY

You can configure MAPS to allow your users to use MAPS Operators over the Internet, in the following two ways:

NOTE: Before you can use either of these methods, you need to have a web server, in other words a computer that has Microsoft Internet Information Services (IIS) installed, which hosts your website.

- Install the **MAPS Web service** on your web server, so that MAPS Operators and/or Designers can connect to your MAPS Server over the Internet.

- Install **MAPS ClickOnce** on your web server, so that your users can launch the fully fledged MAPS Operator - by simply typing your specific URL in Internet Explorer, WITHOUT requiring administrator privileges.
  In other words this performs a “one-touch deployment” of the MAPS Operator, which is typically used in scenarios where software may not be installed on the client machine, such as on corporate networks.

Then once installed the Operator runs normally (as a standalone application that you need to manually connect to your Server) and not as a Web Page within Internet Explorer.

NOTE: The ClickOnce Operator is installed per-user, not per-machine and is sandboxed or isolated from other running programs for added security.

IMPORTANT: At this time ONLY Microsoft Internet Explorer is supported, although other Internet browsers may be supported in future.

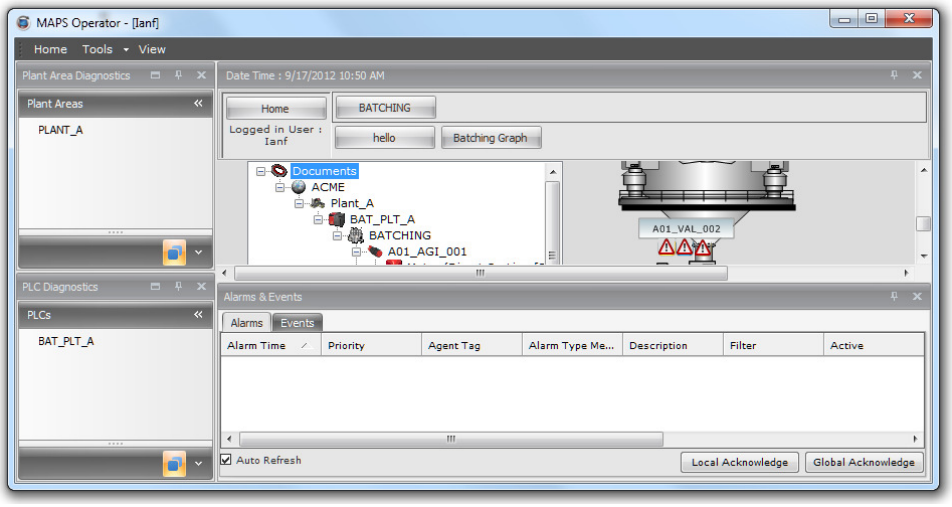


Figure 44 MAPS ClickOnce Operator launched via Internet Explorer

13. ADVANCED MAPS DESIGNER CONFIGURATION OPTIONS

As we mentioned previously, at the start of the MAPS Designer section, the default MAPS Designer layout hides the underlying complexity, so that you can design your MAPS projects. However, for the advanced user, the MAPS Designer provides a number of tools that can extend and enhance the MAPS solution. Some of the more important tools are briefly described here:

- **user management**: apart from user security, which has already been briefly covered, MAPS allows the creation of roaming profiles that allow users to roam among computers and yet still retain their same user settings. Typically these profiles can be used to customize how the Operator is displayed and the permitted user interaction, by specifying certain configuration and security settings.

- **additional datasources**: the MAPS Server can communicate to a number of different external sources of data, such as any OLE DB compliant database, OPC servers and Web services. For each database that you connect to, you can:

  - execute the predefined stored procedures or user-functions
  - create proprietary DataBinders to allow your users to view and/or modify the data within your database.
  - create Queries to perform common tasks for managing and/or obtaining data from your database.
  - create Views to contain any stored (pre-defined) queries in an Access and/or SQL database.

- **additional controls on your graphic forms**: the MAPS Designer provides a **Toolbox** window, which provides a categorized list of controls and components that you can add to your graphic forms to improve their user interface/functionality.

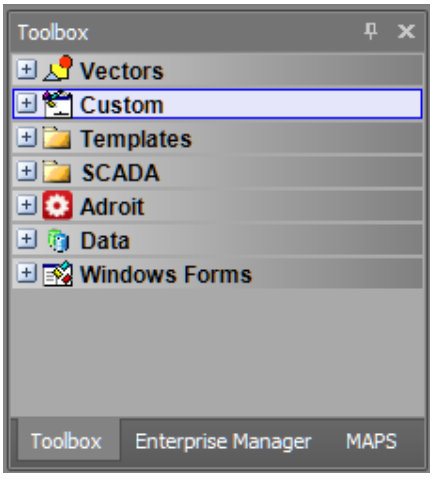


Figure 45 Toolbox

The most commonly used categories are:

- **SCADA** category, which contains SCADA-specific controls, such as gauges, tanks, levels etc.

- **Windows Forms** category, which contains standard .NET controls and components, such as textboxes, buttons etc.

    - **Data** category, which contains charting and database-specific controls, such as the **TrendConfigurator** control that allows your users to configure and save values trended using a LineChart control in a set, which they can then reload when they next logon.
    - **Custom** category, which contains the **FileBrowser** control that allows you to display and/or manage your project documentation.

- **spiders**: spiders and their connections (silks) are essentially a visual programming language, which can transfer and/or manipulate data, typically by means of drag and drop. Spiders communicate and/or manipulate data from a set of inputs to a set of outputs, when they are triggered.

  Typically spiders and silks are used to animate graphic forms by connecting data to the properties exposed by graphic forms and their displayed components (controls).

- **scripting**: this can easily be used in tandem with the other non-scripting programming methods, such as spiders.

  Scripts interact with the Server and/or the Operator through proprietary INeed interfaces, which provide programmatic access to their various components. Each script is seamlessly encapsulated in a script object, which provides the self-contained environment within which the script is run.

  Typically scripting in MAPS will involve **Graphic form scripting**, these scripts programmatically animate or enliven graphic forms, by creating event handlers for events exposed by the graphic form and its added components. In this way, it is possible to provide interaction between components on the graphic form, such as drag drop and mouse handling capabilities etc.

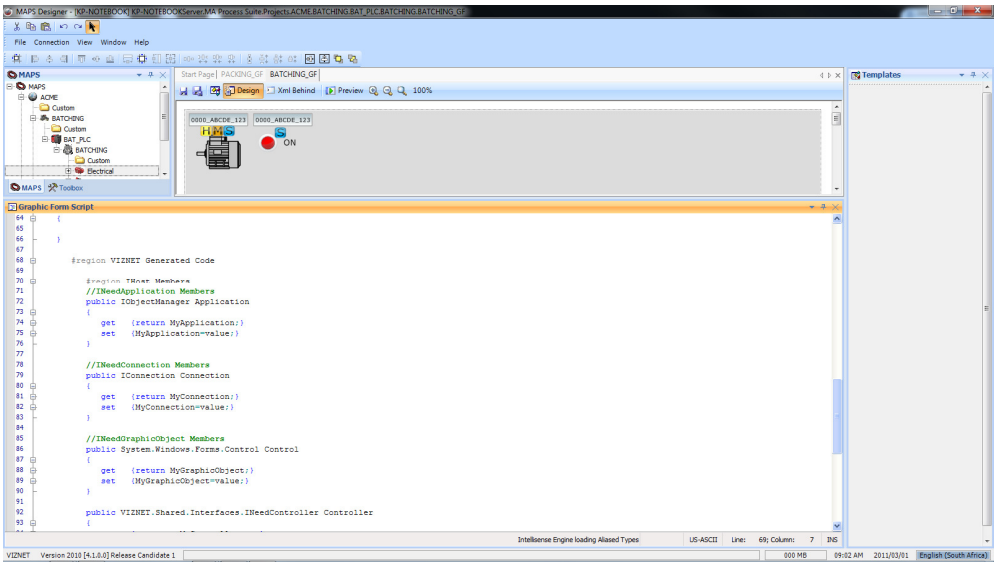


Figure 46 MAPS Graphic Form Script editor

Scripts are usually created and edited in the Designer using the generic Script Editor, however, users can also use Visual Studio 2005 (and later). These scripts can either be written in Microsoft Visual Basic.NET or Microsoft C# (CSharp) scripting languages.

The Script Editor provides standard programming functionality and can provide IntelliSense, a powerful feature that can dramatically reduce the time required to produce your scripts.

For more details on these and the other advanced functionality provided by the MAPS Designer, refer to VIZNET Information Portal technical description or the MAPS Designer help file.

13.1 Related Documents

VIZNET Information Portal 2010 Technical Description:
www.adroit.co.za/downloads/Product%20Documentation/viznet_2010_technical_description.pdf

14. MAPS TEMPLATE REFERENCE

As discussed above, one of the defining characteristics of a MAPS project is the need to assign a MAPS template to each item of equipment in your process. Each MAPS template provides the following:

- an associated PLC function block
- a set of SCADA tags (Adroit agents) linked to the provided signals
- an associated SCADA graphic with inbuilt faceplates

Usually MAPS templates are available in three models – advanced, standard and basic, which provide respectively lower levels of control.

The more advanced the template model, the greater the number of signals (scanned tags) required to represent this item of equipment. This can increase the size (and cost) of your required Adroit licence - so assign these templates to your equipment carefully.

For this reason, each MAPS Templates description includes a **Resources** table, which provides the following summary for each model of a specific MAPS Template:

- the number of physical IO required for the PLC
- the physical steps used for each function block
- the PLC memory usage; and
- the required Adroit Scan point licences.

This therefore enables you to easily estimate the CPU and SCADA licensing required for a MAPS project.

The following MAPS Template documentation can also be opened from the **MAPS Templates** folder of the **MAPS** program group, once MAPS is installed.

Each MAPS template represents an item of electrical or instrumentation equipment. For your ease of reference, we have grouped the available MAPS templates into an electrical and then instrumentation equipment grouping below:

14.1 Electrical Equipment

14.1.1 Motor (2 Speed Direct On Line [DOL]) MAPS Template (Electrical)

The Direct On Line 2 Speed Motor MAPS template is designed to control a motor that is connected as a DOL, which is controlled by two outputs: one for slow speed and another for high speed.

This describes the Advanced Direct On Line 2 Speed Motor MAPS template. For details of its required PLC memory usage; number of PLC I/O and SCADA size (scan points) - see the **Resources** table below.

Advanced DOL 2 Speed Motor Functional Philosophy

The DOL start slow and fast speed outputs are enabled once all interlocks are ready and a start request is received.

Field Interlocks

- MCC (Overload) Trip Feedback
- Isolator On Feedback
- Safety Interlock Feedback
- Motor Current Feedback (Analog Input) (Current above High Limit Setpoint)

PLC Interlocks

- Start Interlock Ready
- Process Interlock Ready
- Restart Delay Interlock
- There are no interlock faults latched

Motor Current: the motor current is monitored constantly after the running setpoint time has elapsed, if the current goes above the high current limit for five seconds the motor will trip on overcurrent.

Interlock fault recovery process: once a field interlock is activated the faceplate will display a red indication, if the interlock is recovered and still latched in the PLC function block and the faceplate will show a green indication and the reset button on the faceplate will flash, pressing on the reset button will unlatch the interlock and display a grey indication and allow the DOL to become ready for operation.

Maintenance mode: disables the Start and Process Interlocks, but respects all the other interlocks. This is used to test a DOL while the process is stopped.

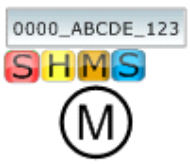
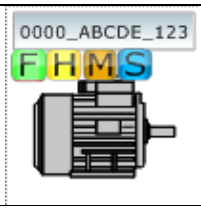
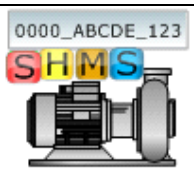
Simulation mode: disables the physical output of the DOL and simulate an input run feedback after the elapsed setpoint time from the faceplate. The Start and Process Interlocks are respected. Simulation mode is used to test the process logic without starting the physical device itself. It is very useful in testing, commissioning and maintenance.

Start and Stop requests: these are initiated by selecting one of the following modes from the DOL faceplate:

- **Auto mode**: the auto control program initiates a start and stop, normal PLC control.
- **Manual mode & Desk mode**: the operator can start and stop from the faceplate.

- **Manual mode & Field mode**: the motor can be started and stopped from the start and stop push buttons in the field.

Typical Faceplate Graphics for the Advanced DOL 2 Speed Motor MAPS Template

DOL ISO	DOL MOTOR LEFT	DOL MOTOR RIGHT	DOL PUMP LEFT	DOL PUMP RIGHT
				

F	Fast Speed Indication
S	Slow Speed Indication
H	Manual Mode
M	Maintenance Mode
S	Simulation Mode
0000_ABCDE_123	Motor Control Name

Graphics legend:

Line colour	Fill colour	DOL status
Black	Grey	Stopped
Grey	White	Stopping
Green	White	Starting
Black	Green	Running
Black	Yellow/Red	Fault Active

Signal Description		Agent Type	Advanced	Standard	Basic
SCADA Control Words:					
SSCL 0	Control Word	**Marshal**	**x**		
SSCL 1	Fail To Start Setpoint	**Analog**	**x**		
SSCL 2	Fail To Stop Setpoint	**Analog**	**x**		
SSCL 3	Running Setpoint	**Analog**	**x**		
SSCL 4	Stopping Setpoint	**Analog**	**x**		
SSCL 5	Simulate Setpoint	**Analog**	**x**		
SSCL 6	Restart Setpoint	**Analog**	**x**		
SSCL 7	Max Current Setpoint (High Limit)	**Analog**	**x**		
SSCL 8	Min In Current Setpoint (Raw Min)	**Analog**	**x**		
SSCL 9	Max In Current Setpoint (Raw Max)	**Analog**	**x**		
SSCL 10	Min Out Current Setpoint (Eng. Min)	**Analog**	**x**		
SSCL 11	Max Out Current Setpoint (Eng. Max)	**Analog**	**x**		

Signal Description		Agent Type	Advanced	Standard	Basic
SCADA Status Words:					
SSSL 0	Status Word	**Marshal**	**x**		
SSSL 1	Starting Time Process Value (actual)	**Analog**	**x**		
SSSL 2	Stopping Time Process Value (actual)	**Analog**	**x**		
SSSL 3	No of Operations (actual)	**Analog**	**x**		
SSSL 4	Restart Delay Time Remaining (actual)	**Analog**	**x**		
SSSL 5	Motor Current Process Value (actual)	**Analog**	**x**		
SSSL 6	Total Running Hours	**Analog**	**x**		

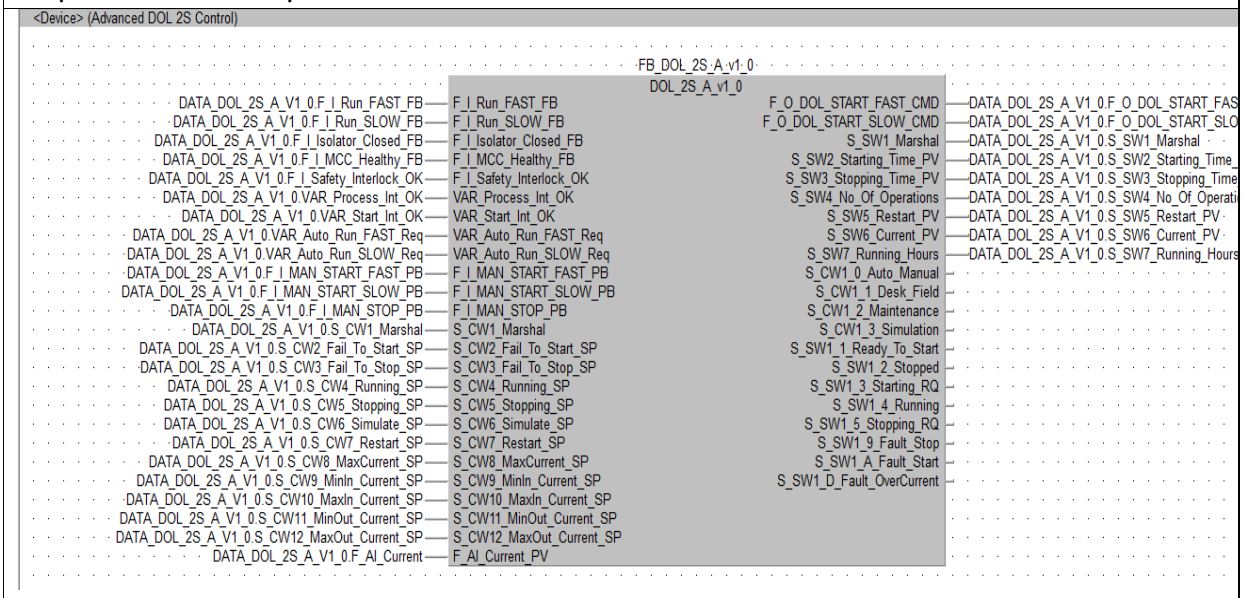
Digital Inputs:		Advanced	Standard	Basic
DI 0	Running Signal Fast (On = Healthy)	x		
DI 1	Running Signal Slow (On = Healthy)	x		
DI 2	Isolator Healthy (On = Healthy)	x		
DI 3	MCC Healthy (On = Healthy)	x		
DI 4	Safety Interlock Healthy (On = Healthy)	x		
DI 5	Manual Start Push Button Fast (On = Start)	x		
DI 6	Manual Start Push Button Slow (On = Start)	x		
DI 7	Manual Stop Push Button (Off = Stop)	x		
Digital Outputs:				
DO 0	Device Start Fast	x		
DO 1	Device Start Slow	x		
Analog Input:				
AI 0	Analog Input for Current Drawn	x		

SCADA Control Word (Adroit Marshal Agent)		Event Logged	Advanced	Standard	Basic
Bit 0	Auto/Manual	x	x		
Bit 1	Field/Desk	x	x		
Bit 2	Maintenance	x	x		
Bit 3	Simulation	x	x		
Bit 4	Alarms All Reset		x		
Bit 5	Reset No Operations Accumulator	x	x		
Bit 6	Start Command	x	x		
Bit 7	Reset Running Hours Accumulator	x	x		
Bit 8	Stop Command	x	x		
Bit 9	Spare				
Bit 10	Spare				
Bit 11	Spare				
Bit 12	Spare				
Bit 13	Spare				
Bit 14	Fast Speed Command	x	x		
Bit 15	Slow Speed Command	x	x		

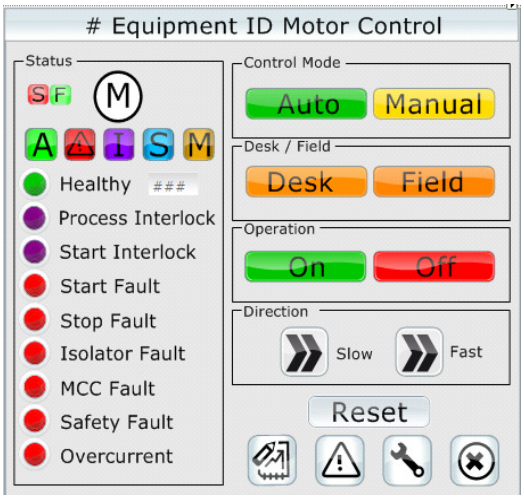
SCADA Status Word (Adroit Marshal Agent)		Alarmed	Advanced	Standard	Basic
Bit 0	Process Interlock		x		
Bit 1	Ready To Start		x		
Bit 2	Stopped		x		
Bit 3	Starting		x		
Bit 4	Running		x		
Bit 5	Stopping		x		
Bit 6	Fault		x		
Bit 7	Start Interlock OK		x		
Bit 8	Isolator Closed Fault	x	x		
Bit 9	Fault Fail To Stop	x	x		
Bit 10	Fault Fail To Start	x	x		
Bit 11	MCC Fault	x	x		
Bit 12	Safety Fault	x	x		
Bit 13	Overcurrent Fault	x	x		
Bit 14	Spare				
Bit 15	Fast / Slow Speed Indication		x		

Resources	Advanced	Standard	Basic
Digital Inputs	8		
Digital Outputs	2		
Analog Inputs	1		
Analog Outputs	0		
PLC Memory Steps	565		
System Words Used	54		
System Bits Used	106		
SCADA Scan Points	19		

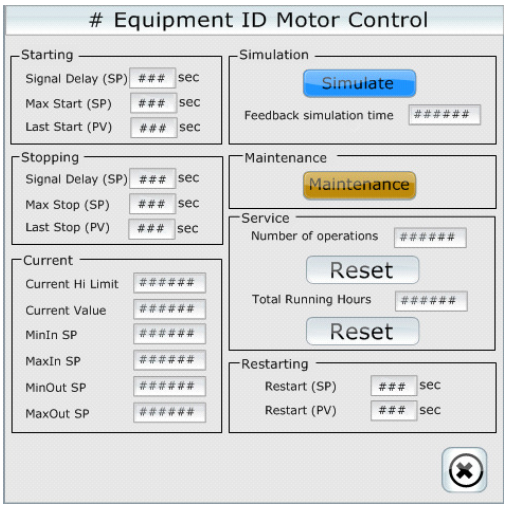
Template: Advanced DOL 2 Speed PLC Function Block

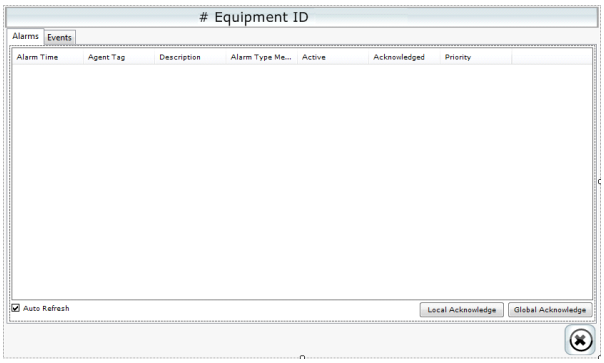


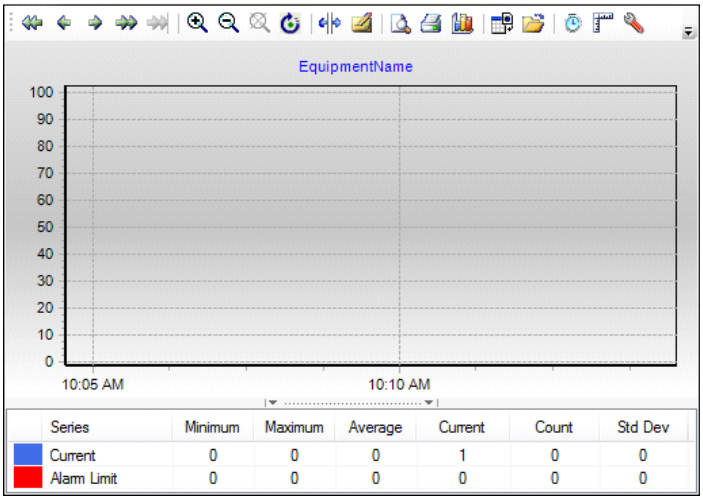
Template Graphic: Advanced Home Screen



Control	Descriptions
Auto	Auto control by PLC
Manual	Manual control by operator, desk and field mode
Desk	Manual control from the SCADA faceplate
Field	Manual control from the field start/stop station
On	Manual start the DOL
Off	Manual stop the DOL
Reset	Reset the DOL after a fault has been repaired
Healthy ###	Healthy to start, ### - Restart delay countdown in
Process Interlock	DOL process ok to run interlock ready
Start Interlock	DOL ok to start interlock ready
Start Fault	DOL failed to start fault
Stop Fault	DOL failed to stop fault
Isolator Fault	DOL isolator off fault
MCC Fault	DOL MCC tripped fault
Safety Fault	DOL Safety off fault
Overcurrent	DOL overcurrent fault
Slow	Slow speed selection and indication
Fast	Fast speed selection and indication

Template Graphic: Advanced Setup Screen	Control	Descriptions
	Simulate	Enable simulation of DOL, disables the physical output
	Feedback Time	Time for simulation to simulate run feedback signal
	Maintenance	Enable maintenance mode (Disables all interlocks)
	Number of operations	Total number of DOL start operations
	Running Hours	Total number of DOL running hours
	Reset	Reset the total counter of the current service
	Start Signal Delay (SP)	Delay the PLC to accept the DOL is running
	Max Start (SP)	Time for running signal is on after start signal is on
	Last Start (PV)	Last time for running signal was on after start signal was on
	Stop Signal Delay (SP)	Delay the PLC to accept the DOL is stopped
	Max Stop (SP)	Time running signal is off after start signal is off
	Last Stop (PV)	Last time running signal was off after start signal was off
	Current Hi Limit	Sets the value of the maximum current for the DOL to trip at
	Current Value	Actual current the DOL is running at
	MinIn, MaxIn	Raw current input values for scaling
	MinOut, MaxOut	Engineering current values for scaling
	Restart (SP)	Restart prevention time of the DOL setpoint
	Restart (PV)	Remaining time before a DOL restart is allowed

Template Graphic: Advanced Alarms & Events Screen	Control	Descriptions
	Alarms	Display all the alarms filtered for the current Digital Output
	Events	Display all the events filtered for the current Digital Output.
	Local Acknowledge	Acknowledge all the alarms on locally on the current machine
	Global Acknowledge	Acknowledge all the alarms on globally on all the machines.

Template Graphic: Advanced Trend Screen	Control	Descriptions
	Current	Display the current of the DOL in the trend, with minimum, maximum and average values.
	Alarm Limit	Display the current Setpoint of alarming on high current of the DOL in the trend, with minimum, maximum and average values.

14.1.2 Motor (Direct On Line [DOL]) MAPS Template (Electrical)

The Direct On Line (DOL) Motor MAPS template is designed to control a motor that is connected as a DOL.

This MAPS template is available in three models – advanced, standard and basic, which provide respectively lower levels of control over the DOL motor.

This describes the Advanced DOL Motor MAPS Template and also defines the level of functionality provided by the standard and basic models. So that you can decide which model best suits your needs. You should consider the following factors in your choice:

- the importance of the DOL motor being controlled and
- the budget of the customer

Since the more complex the model, the greater the required PLC memory usage; number of PLC I/O and SCADA size (scan points) - see the **Resources** table below.

This also provides a typical electrical schematic for the Advanced DOL Motor MAPS Template.

Advanced DOL Motor Functional Philosophy

The DOL start output is enabled once all interlocks are ready and a start request is received.

Field Interlocks

- MCC (Overload) Trip Feedback
- Isolator On Feedback
- Safety Interlock Feedback
- Motor Current Feedback (Analog Input) (Current above High Limit Setpoint)

PLC Interlocks

- Start Interlock Ready
- Process Interlock Ready
- Restart Delay Interlock
- There are no interlock faults latched

Interlock fault recovery process: once a field interlock is activated the faceplate will display a red indication, if the interlock is recovered and still latched in the PLC function block and the faceplate will show a green indication and the reset button on the faceplate will flash, pressing on the reset button will unlatch the interlock and display a grey indication and allow the DOL to become ready for operation.

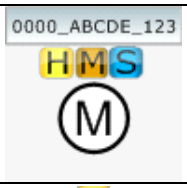
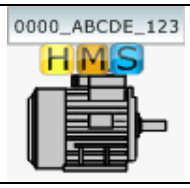
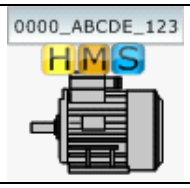
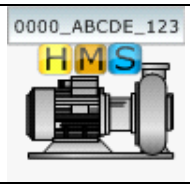
Maintenance mode: disables the Start and Process Interlocks, but respects all the other interlocks. This is used to test a DOL while the process is stopped.

Simulation mode: disables the physical output of the DOL and simulate an input run feedback after the elapsed setpoint time from the faceplate. The Start and Process Interlocks are respected. Simulation mode is used to test the process logic without starting the physical device itself. It is very useful in testing, commissioning and maintenance.

Start and Stop requests: these are initiated by selecting one of the following modes from the DOL faceplate:

- **Auto mode**: the auto control program initiates a start and stop, normal PLC control.
- **Manual mode & Desk mode**: the operator can start and stop from the faceplate.
- **Manual mode & Field mode**: the motor can be started and stopped from the start and stop push buttons in the field.

Typical Faceplate Graphics for the Advanced DOL Motor MAPS Template

DOL ISO	DOL MOTOR LEFT	DOL MOTOR RIGHT	DOL PUMP LEFT	DOL PUMP RIGHT
				
	Manual Mode			
	Maintenance Mode			
	Simulation Mode			
	Motor Control Name			

Graphics legend:

Line colour	Fill colour	DOL status
Black	Grey	Stopped
Grey	White	Stopping
Green	White	Starting
Black	Green	Running
Black	Yellow/Red	Fault Active

Signal Description		Agent Type	Advanced	Standard	Basic
SCADA Control Words:					
SSCL 0	Control Word	**Marshal**	**x**	**x**	**x**
SSCL 1	Fail To Start Setpoint	**Analog**	**x**	**x**	**x**
SSCL 2	Fail To Stop Setpoint	**Analog**	**x**	**x**	
SSCL 3	Running Setpoint	**Analog**	**x**	**x**	**x**
SSCL 4	Stopping Setpoint	**Analog**	**x**	**x**	
SSCL 5	Simulate Setpoint	**Analog**	**x**	**x**	**x**
SSCL 6	Restart Setpoint	**Analog**	**x**	**x**	
SSCL 7	Max Current Setpoint (High Limit)	**Analog**	**x**		
SSCL 8	Min In Current Setpoint (Raw Min)	**Analog**	**x**		
SSCL 9	Max In Current Setpoint (Raw Max)	**Analog**	**x**		
SSCL 10	Min Out Current Setpoint (Eng. Min)	**Analog**	**x**		
SSCL 11	Max Out Current Setpoint (Eng. Max)	**Analog**	**x**		

Signal Description		Agent Type	Advanced	Standard	Basic
SCADA Status Words:					
SSSL 0	Status Word	**Marshal**	**x**	**x**	**x**
SSSL 1	Starting Time Process Value (actual)	**Analog**	**x**	**x**	**x**
SSSL 2	Stopping Time Process Value (actual)	**Analog**	**x**	**x**	
SSSL 3	No of Operations (actual)	**Analog**	**x**	**x**	
SSSL 4	Restart Delay Time Remaining (actual)	**Analog**	**x**	**x**	
SSSL 5	Motor Current Process Value (actual)	**Analog**	**x**		
SSSL 6	Total Running Hours	**Analog**	**x**		

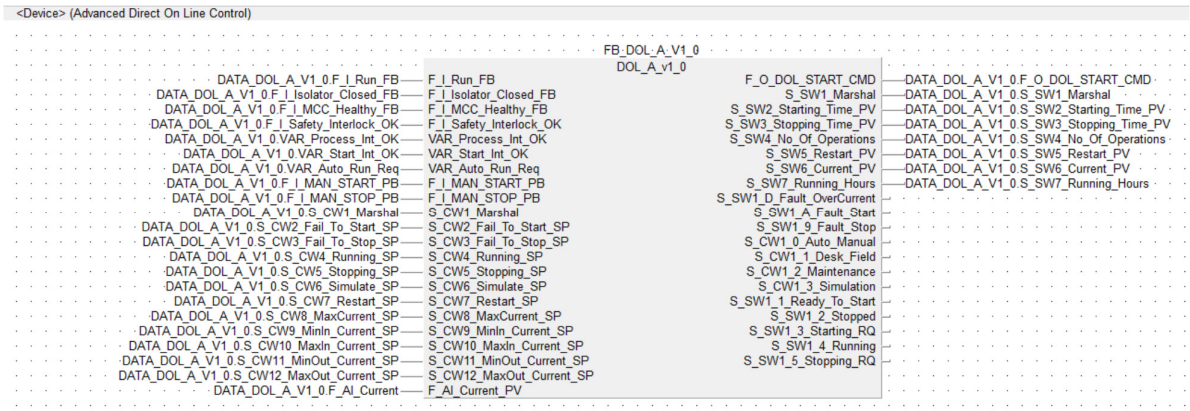
Digital Inputs:		Advanced	Standard	Basic
DI 0	Running Signal (On = Healthy)	x	x	x
DI 1	Isolator Healthy (On = Healthy)	x	x	
DI 2	MCC Healthy (On = Healthy)	x	x	x
DI 3	Safety Interlock Healthy (On = Healthy)	x	x	x
DI 4	Manual Start Push Button (On = Start)	x	x	
DI 5	Manual Stop Push Button (Off = Stop)	x	x	
Digital Outputs:				
DO 0	Device Start	x	x	x
Analog Input:				
AI 0	Analog Input for Current Drawn	x		

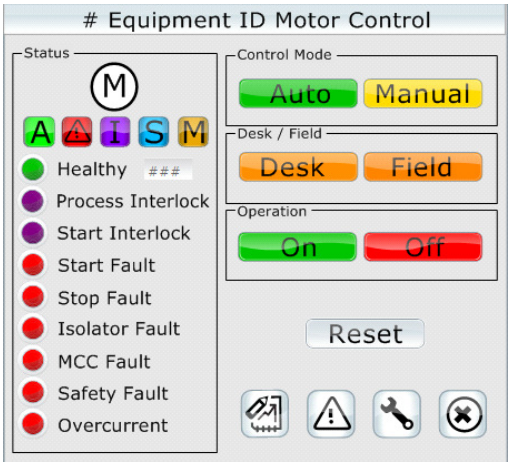
SCADA Control Word (Adroit Marshal Agent)		Event Logged	Advanced	Standard	Basic
Bit 0	Auto/Manual	x	x	x	x
Bit 1	Field/Desk	x	x	x	x
Bit 2	Maintenance	x	x	x	x
Bit 3	Simulation	x	x	x	x
Bit 4	Alarms All Reset		x	x	x
Bit 5	Reset No Operations Accumulator	x	x	x	
Bit 6	Start Command	x	x	x	x
Bit 7	Reset Running Hours Accumulator	x	x		
Bit 8	Stop Command	x	x	x	x
Bit 9	Spare				
Bit 10	Spare				
Bit 11	Spare				
Bit 12	Spare				
Bit 13	Spare				
Bit 14	Spare				
Bit 15	Spare				

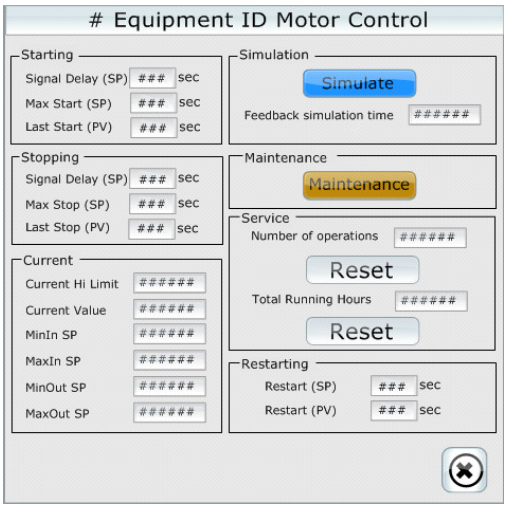
SCADA Status Word (Adroit Marshal Agent)		Alarmed	Advanced	Standard	Basic
Bit 0	Process Interlock		x	x	x
Bit 1	Ready To Start		x	x	x
Bit 2	Stopped		x	x	x
Bit 3	Starting		x	x	x
Bit 4	Running		x	x	x
Bit 5	Stopping		x	x	x
Bit 6	Fault		x	x	x
Bit 7	Start Interlock OK		x	x	x
Bit 8	Isolator Closed Fault	x	x	x	
Bit 9	Fault Fail To Stop	x	x	x	
Bit 10	Fault Fail To Start	x	x	x	x
Bit 11	MCC Fault	x	x	x	x
Bit 12	Safety Fault	x	x	x	x
Bit 13	Overcurrent Fault	x	x		
Bit 14	Spare				
Bit 15	Spare				

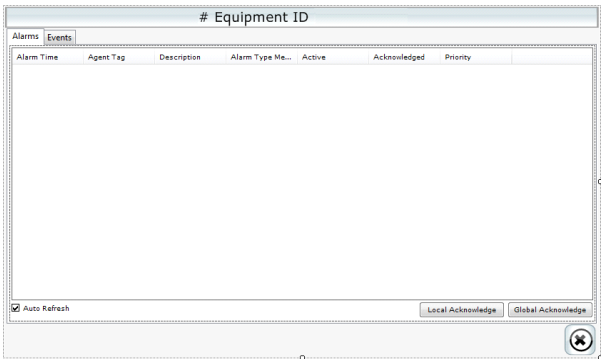
Resources	Advanced	Standard	Basic
Digital Inputs	6	6	3
Digital Outputs	1	1	1
Analog Inputs	1	0	0
Analog Outputs	0	0	0
PLC Memory Steps	518	299	205
System Words Used	53	22	19
System Bits Used	92	80	73
SCADA Scan Points	19	12	6

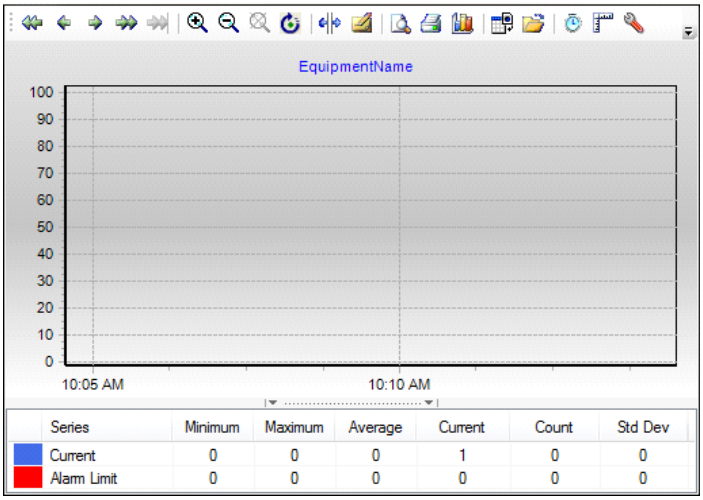
Template: Advanced DOL PLC Function Block



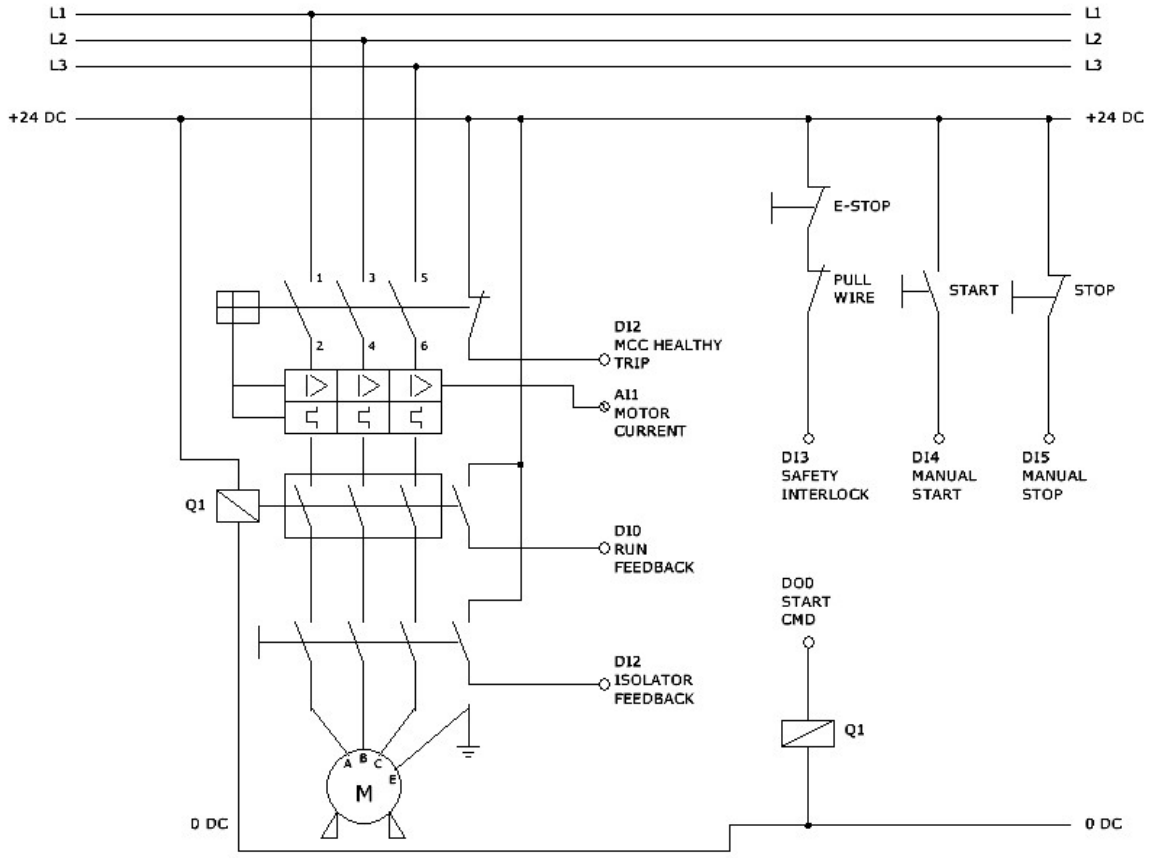
Template Graphic: Advanced Home Screen	Control	Descriptions
	Auto	Auto control by PLC
	Manual	Manual control by operator, desk and field mode
	Desk	Manual control from the SCADA faceplate
	Field	Manual control from the field start/stop station
	On	Manual start the DOL
	Off	Manual stop the DOL
	Reset	Reset the DOL after a fault has been repaired
	Healthy ###	Healthy to start, ### - Restart delay countdown in
	Process Interlock	DOL process ok to run interlock ready
	Start Interlock	DOL ok to start interlock ready
	Start Fault	DOL failed to start fault
	Stop Fault	DOL failed to stop fault
	Isolator Fault	DOL isolator off fault
	MCC Fault	DOL MCC tripped fault
	Safety Fault	DOL Safety off fault
	Overcurrent	DOL overcurrent fault

Template Graphic: Advanced Setup Screen	Control	Descriptions
	Simulate	Enable simulation of DOL, disables the physical output
	Feedback Time	Time for simulation to simulate run feedback signal
	Maintenance	Enable maintenance mode (Disables all interlocks)
	Number of operations	Total number of DOL start operations
	Running Hours	Total number of DOL running hours
	Reset	Reset the total counter of the current service
	Start Signal Delay (SP)	Delay the PLC to accept the DOL is running
	Max Start (SP)	Time for running signal is on after start signal is on
	Last Start (PV)	Last time for running signal was on after start signal was on
	Stop Signal Delay (SP)	Delay the PLC to accept the DOL is stopped
	Max Stop (SP)	Time running signal is off after start signal is off
	Last Stop (PV)	Last time running signal was off after start signal was off
	Current Hi Limit	Sets the value of the maximum current for the DOL to trip at
	Current Value	Actual current the DOL is running at
	MinIn, MaxIn	Raw current input values for scaling
	MinOut, MaxOut	Engineering current values for scaling
	Restart (SP)	Restart prevention time of the DOL setpoint
	Restart (PV)	Remaining time before a DOL restart is allowed

Template Graphic: Advanced Alarms & Events Screen	Control	Descriptions
	Alarms	Display all the alarms filtered for the current Digital Output
	Events	Display all the events filtered for the current Digital Output.
	Local Acknowledge	Acknowledge all the alarms on locally on the current machine
	Global Acknowledge	Acknowledge all the alarms on globally on all the machines.

Template Graphic: Advanced Trend Screen	Control	Descriptions
	Current	Display the current of the DOL in the trend, with minimum, maximum and average values.
	Alarm Limit	Display the current Setpoint of alarming on high current of the DOL in the trend, with minimum, maximum and average values.

Typical Electrical Wiring Schematic Diagram of an Advanced DOL



14.1.3 Motor (Direct On Line [DOL]) Very Basic MAPS Template (Electrical)

The Very Basic Direct On Line (DOL) Motor MAPS template is designed to control a motor that is connected as a DOL.
All MAPS templates provide the following:

- an associated PLC function block
- a set of SCADA tags (Adroit agents) linked to the provided signals
- an associated SCADA graphic with inbuilt faceplates

This document describes the Very Basic DOL Motor MAPS Template, which provides the lowest level of control over the DOL motor. For details of its required PLC memory usage; number of PLC I/O and SCADA size (scan points) - see the **Resources** table below.

Very Basic DOL Motor Functional Philosophy

The DOL start output is enabled once all interlocks are ready and a start request is received.

Field Interlocks

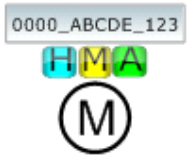
- Trip Feedback
- Fault Feedback
-

Interlock fault recovery process – once a field interlock is activated the faceplate will display a red indication, if the interlock is recovered and still latched in the PLC function block and the faceplate will show a green indication and the reset button on the faceplate will flash, pressing the Reset button will unlatch the interlock and display a grey indication and allow the DOL to become ready for operation.

Start and stop requests are initiated by selecting a mode on the DOL faceplate:

- **Auto mode** - the auto control program initiates a start and stop, normal PLC control.
- **Manual mode** - the operator can start and stop from the faceplate.
- **Hand mode** - the motor is in PLC bypass mode.

Typical Faceplate Graphics for the Very Basic DOL Motor MAPS Template

DOL ISO	DOL Aerator	DOL Standard Pump Side View Left	DOL PUMP LEFT	DOL PUMP RIGHT
				

	Hand Mode
	Manual Mode
	Auto Mode
	Motor Control Name

Graphics legend:

Line colour	Fill colour	DOL status
Black	Grey	Stopped
Grey	White	Stopping
Green	White	Starting
Black	Green	Running
Black	Yellow/Red	Fault Active

Signal Description		Agent Type	Very Basic
SCADA Control Words:			
SSCL 0	Control Word	**Marshal**	**x**

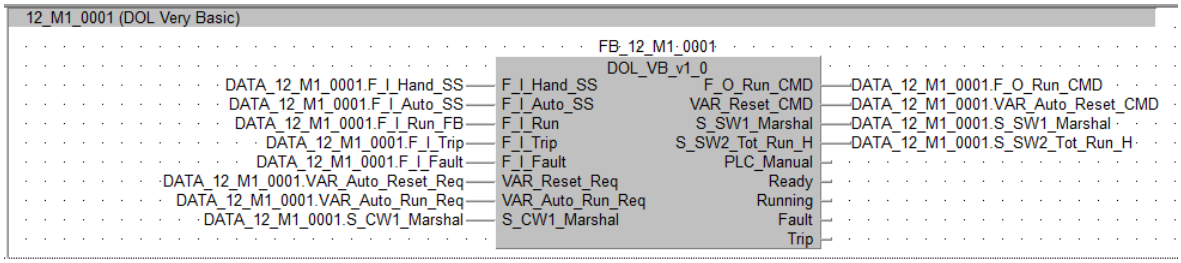
Signal Description		Agent Type	Very Basic
SCADA Status Words:			
SSSL 0	Status Word	**Marshal**	**x**
SSSL 1	Total Running Hours	**Analog**	**x**

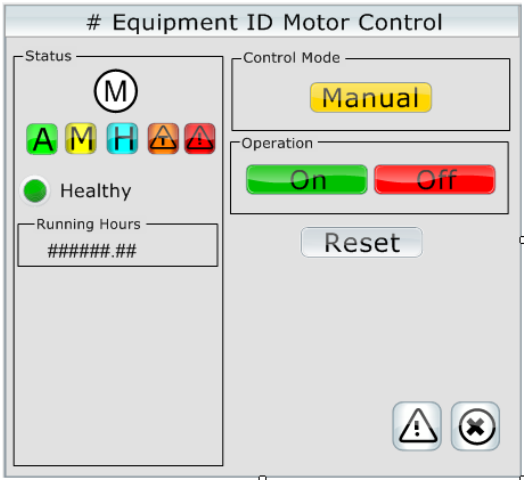
Digital Inputs:		Very Basic
DI 0	Hand (On = Hand)	**x**
DI 1	Auto (On = Auto)	**x**
DI 2	Run Feedback (On = Running)	**x**
DI 3	Trip (On = Tripped)	**x**
DI 4	Fault (On = Fault)	**x**
Digital Outputs:		
DO 0	Device Start	**x**

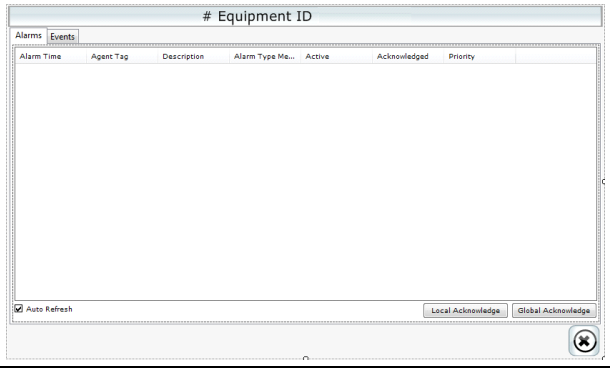
SCADA Control Word (Adroit Marshal Agent)		Event Logged	Very Basic
Bit 0	Alarms All Reset	x	x
Bit 1	Manual	x	x
Bit 2	Start Command	x	x
Bit 3	Stop Command	x	x
Bit 4	Spare		
Bit 5	Spare		
Bit 6	Spare		
Bit 7	Spare		
Bit 8	Spare		
Bit 9	Spare		
Bit 10	Spare		
Bit 11	Spare		
Bit 12	Spare		
Bit 13	Spare		
Bit 14	Spare		
Bit 15	Spare		

SCADA Status Word (Adroit Marshal Agent)		Alarmed	Very Basic
Bit 0	Hand		x
Bit 1	Auto		x
Bit 2	Manual		x
Bit 3	Ready		x
Bit 4	Starting		x
Bit 5	Running		x
Bit 6	Trip	x	x
Bit 7	Fault	x	x
Bit 8	Spare		
Bit 9	Spare		
Bit 10	Spare		
Bit 11	Spare		
Bit 12	Spare		
Bit 13	Spare		
Bit 14	Spare		
Bit 15	Spare		

Resources	Very Basic
Digital Inputs	5
Digital Outputs	1
Analog Inputs	0
Analog Outputs	0
PLC Memory Steps	178
System Words Used	9
System Bits Used	66
SCADA SCAN Points	2

Template: Very Basic DOL PLC Function Block


Template Graphic: Home Screen	Control	Descriptions
	Manual	Manual control by the operator
	On	Manually start the DOL
	Off	Manually stop the DOL
	Reset	Reset the DOL after a fault has been repaired
	Healthy	Healthy to start the DOL

Template Graphic: Alarms & Events Screen	Control	Descriptions
	Alarms	Display all the alarms filtered for the current Digital Output
	Events	Display all the events filtered for the current Digital Output.
	Local Acknowledge	Acknowledge all the alarms on locally on the current machine
	Global Acknowledge	Acknowledge all the alarms on globally on all the machines.

14.1.4 Motor (Forward Reverse Direct On Line [DOL]) MAPS Template (Electrical)

The Direct On Line Forward - Reverse Motor MAPS template is designed to control a motor that is connected as a DOL, which is controlled by two outputs: one for forward direction and another for the reverse direction.

This describes the Advanced Direct On Line Forward - Reverse Motor MAPS template. For details of its required PLC memory usage; number of PLC I/O and SCADA size (scan points) - see the **Resources** table below.

Advanced DOL Forward - Reverse Motor Functional Philosophy

The DOL start forward and reverse direction outputs are enabled once all interlocks are ready and a start request is received.

Field Interlocks

- MCC (Overload) Trip Feedback
- Isolator On Feedback
- Safety Interlock Feedback
- Motor Current Feedback (Analog Input) (Current above High Limit Setpoint)

PLC Interlocks

- Start Interlock Ready
- Process Interlock Ready
- Restart Delay Interlock
- There are no interlock faults latched

Motor Current: the motor current is monitored constantly after the running setpoint time has elapsed, if the current goes above the high current limit for five seconds the motor will trip on overcurrent.

Interlock fault recovery process: once a field interlock is activated the faceplate will display a red indication, if the interlock is recovered and still latched in the PLC function block and the faceplate will show a green indication and the reset button on the faceplate will flash, pressing on the reset button will unlatch the interlock and display a grey indication and allow the DOL to become ready for operation.

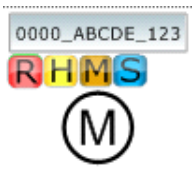
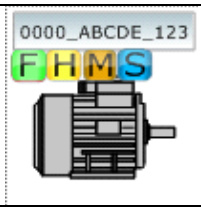
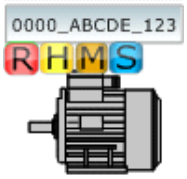
Maintenance mode: disables the Start and Process Interlocks, but respects all the other interlocks. This is used to test a DOL while the process is stopped.

Simulation mode: disables the physical output of the DOL and simulate an input run feedback after the elapsed setpoint time from the faceplate. The Start and Process Interlocks are respected. Simulation mode is used to test the process logic without starting the physical device itself. It is very useful in testing, commissioning and maintenance.

Start and Stop requests: these are initiated by selecting one of the following modes from the DOL faceplate:

- **Auto mode**: the auto control program initiates a start and stop, normal PLC control.
- **Manual mode & Desk mode**: the operator can start and stop from the faceplate.
- **Manual mode & Field mode**: the motor can be started and stopped from the start and stop push buttons in the field.

Typical Faceplate Graphics for the Advanced DOL Forward - Reverse Motor MAPS Template

DOL ISO	DOL MOTOR LEFT	DOL MOTOR RIGHT	DOL PUMP LEFT	DOL PUMP RIGHT
				

	DOL Reverse Direction Indication
	DOL Forward Direction Indication
	Manual Mode
	Maintenance Mode
	Simulation Mode
	Motor Control Name

Graphics legend:

Line colour	Fill colour	DOL status
Black	Grey	Stopped
Grey	White	Stopping
Green	White	Starting
Black	Green	Running
Black	Yellow/Red	Fault Active

Signal Description		Agent Type	Advanced	Standard	Basic
SCADA Control Words:					
SSCL 0	Control Word	**Marshal**	**x**		
SSCL 1	Fail To Start Setpoint	**Analog**	**x**		
SSCL 2	Fail To Stop Setpoint	**Analog**	**x**		
SSCL 3	Running Setpoint	**Analog**	**x**		
SSCL 4	Stopping Setpoint	**Analog**	**x**		
SSCL 5	Simulate Setpoint	**Analog**	**x**		
SSCL 6	Restart Setpoint	**Analog**	**x**		
SSCL 7	Max Current Setpoint (High Limit)	**Analog**	**x**		
SSCL 8	Min In Current Setpoint (Raw Min)	**Analog**	**x**		
SSCL 9	Max In Current Setpoint (Raw Max)	**Analog**	**x**		
SSCL 10	Min Out Current Setpoint (Eng. Min)	**Analog**	**x**		
SSCL 11	Max Out Current Setpoint (Eng. Max)	**Analog**	**x**		

Signal Description		Agent Type	Advanced	Standard	Basic
SCADA Status Words:					
SSSL 0	Status Word	**Marshal**	**x**		
SSSL 1	Starting Time Process Value (actual)	**Analog**	**x**		
SSSL 2	Stopping Time Process Value (actual)	**Analog**	**x**		
SSSL 3	No of Operations (actual)	**Analog**	**x**		
SSSL 4	Restart Delay Time Remaining (actual)	**Analog**	**x**		
SSSL 5	Motor Current Process Value (actual)	**Analog**	**x**		
SSSL 6	Total Running Hours	**Analog**	**x**		

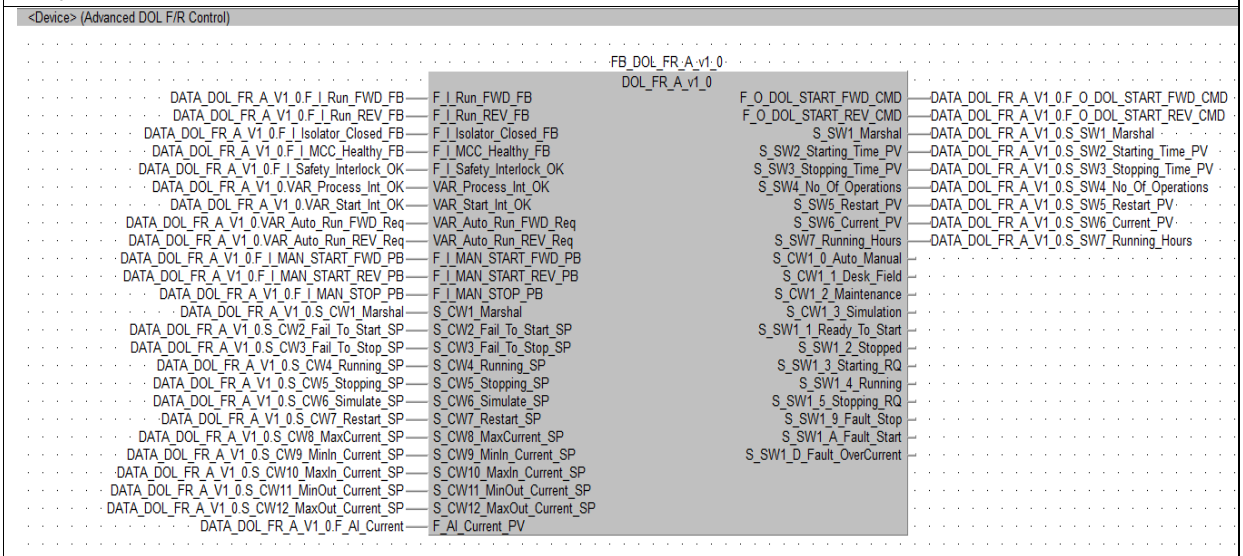
Digital Inputs:		Advanced	Standard	Basic
DI 0	Running Signal Forward (On = Healthy)	x		
DI 1	Running Signal Reverse (On = Healthy)	x		
DI 2	Isolator Healthy (On = Healthy)	x		
DI 3	MCC Healthy (On = Healthy)	x		
DI 4	Safety Interlock Healthy (On = Healthy)	x		
DI 5	Manual Start Push Button Forward (On = Start)	x		
DI 6	Manual Start Push Button Reverse (On = Start)	x		
DI 7	Manual Stop Push Button (Off = Stop)	x		
Digital Outputs:				
DO 0	Device Start Forward	x		
DO 1	Device Start Reverse	x		
Analog Input:				
AI 0	Analog Input for Current Drawn	x		

SCADA Control Word (Adroit Marshal Agent)		Event Logged	Advanced	Standard	Basic
Bit 0	Auto/Manual	x	x		
Bit 1	Field/Desk	x	x		
Bit 2	Maintenance	x	x		
Bit 3	Simulation	x	x		
Bit 4	Alarms All Reset		x		
Bit 5	Reset No Operations Accumulator	x	x		
Bit 6	Start Command	x	x		
Bit 7	Reset Running Hours Accumulator	x	x		
Bit 8	Stop Command	x	x		
Bit 9	Spare				
Bit 10	Spare				
Bit 11	Spare				
Bit 12	Spare				
Bit 13	Spare				
Bit 14	Forward Command	x	x		
Bit 15	Reverse Command	x	x		

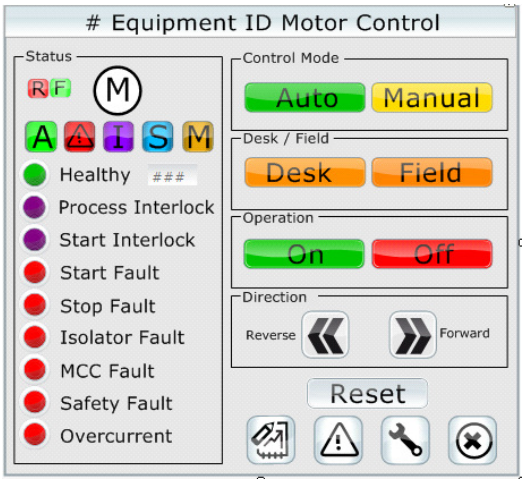
SCADA Status Word (Adroit Marshal Agent)		Alarmed	Advanced	Standard	Basic
Bit 0	Process Interlock		x		
Bit 1	Ready To Start		x		
Bit 2	Stopped		x		
Bit 3	Starting		x		
Bit 4	Running		x		
Bit 5	Stopping		x		
Bit 6	Fault		x		
Bit 7	Start Interlock OK		x		
Bit 8	Isolator Closed Fault	x	x		
Bit 9	Fault Fail To Stop	x	x		
Bit 10	Fault Fail To Start	x	x		
Bit 11	MCC Fault	x	x		
Bit 12	Safety Fault	x	x		
Bit 13	Overcurrent Fault	x	x		
Bit 14	Spare				
Bit 15	Forward Reverse Status Indication		x		

Resources	Advanced	Standard	Basic
Digital Inputs	8		
Digital Outputs	2		
Analog Inputs	1		
Analog Outputs	0		
PLC Memory Steps	577		
System Words Used	73		
System Bits Used	141		
SCADA Scan Points	19		

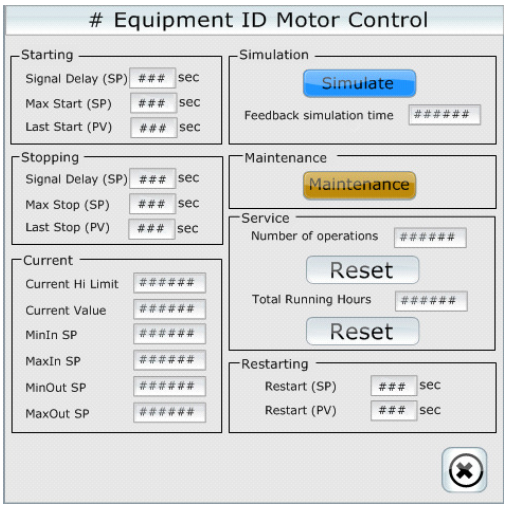
Template: Advanced DOL Forward - Reverse PLC Function Block

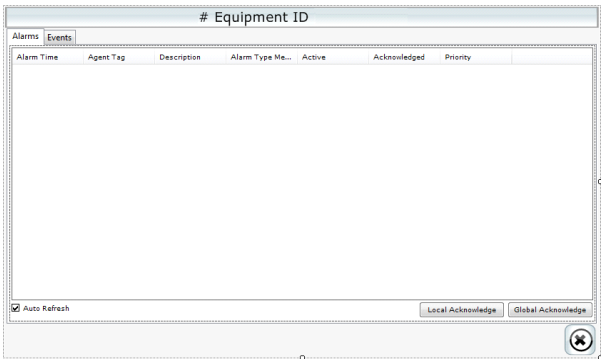


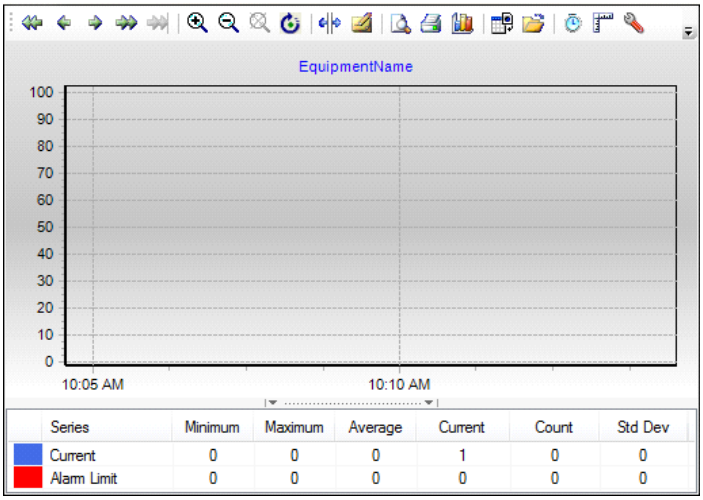
Template Graphic: Advanced Home Screen



Control	Descriptions
Auto	Auto control by PLC
Manual	Manual control by operator, desk and field mode
Desk	Manual control from the SCADA faceplate
Field	Manual control from the field start/stop station
On	Manual start the DOL
Off	Manual stop the DOL
Reset	Reset the DOL after a fault has been repaired
Healthy ###	Healthy to start, ### - Restart delay countdown in
Process Interlock	DOL process ok to run interlock ready
Start Interlock	DOL ok to start interlock ready
Start Fault	DOL failed to start fault
Stop Fault	DOL failed to stop fault
Isolator Fault	DOL isolator off fault
MCC Fault	DOL MCC tripped fault
Safety Fault	DOL Safety off fault
Overcurrent	DOL overcurrent fault
Reverse	DOL reverse direction selection and indication
Forward	DOL forward direction selection and indication

Template Graphic: Advanced Setup Screen	Control	Descriptions
	Simulate	Enable simulation of DOL, disables the physical output
	Feedback Time	Time for simulation to simulate run feedback signal
	Maintenance	Enable maintenance mode (Disables all interlocks)
	Number of operations	Total number of DOL start operations
	Running Hours	Total number of DOL running hours
	Reset	Reset the total counter of the current service
	Start Signal Delay (SP)	Delay the PLC to accept the DOL is running
	Max Start (SP)	Time for running signal is on after start signal is on
	Last Start (PV)	Last time for running signal was on after start signal was on
	Stop Signal Delay (SP)	Delay the PLC to accept the DOL is stopped
	Max Stop (SP)	Time running signal is off after start signal is off
	Last Stop (PV)	Last time running signal was off after start signal was off
	Current Hi Limit	Sets the value of the maximum current for the DOL to trip at
	Current Value	Actual current the DOL is running at
	MinIn, MaxIn	Raw current input values for scaling
	MinOut, MaxOut	Engineering current values for scaling
	Restart (SP)	Restart prevention time of the DOL setpoint
	Restart (PV)	Remaining time before a DOL restart is allowed

Template Graphic: Advanced Alarms & Events Screen	Control	Descriptions
	Alarms	Display all the alarms filtered for the current Digital Output
	Events	Display all the events filtered for the current Digital Output.
	Local Acknowledge	Acknowledge all the alarms on locally on the current machine
	Global Acknowledge	Acknowledge all the alarms on globally on all the machines.

Template Graphic: Advanced Trend Screen	Control	Descriptions
	Current	Display the current of the DOL in the trend, with minimum, maximum and average values.
	Alarm Limit	Display the current Setpoint of alarming on high current of the DOL in the trend, with minimum, maximum and average values.

14.1.5 Motor (Forward Reverse Direct On Line [DOL]) Very Basic MAPS Template (Electrical)

The Very Basic Direct On Line Forward Reverse (DOL_FR_VB) Motor MAPS template is designed to control a motor that is connected as a Forward Reverse DOL.
All MAPS templates provide the following:

- an associated PLC function block
- a set of SCADA tags (Adroit agents) linked to the provided signals
- an associated SCADA graphic with inbuilt faceplates

This document describes the Very Basic Forward Reverse DOL Motor MAPS Template, which provides the lowest level of control over the Forward Reverse DOL motor. For details of its required PLC memory usage; number of PLC I/O and SCADA size (scan points) - see the **Resources** table below.

Very Basic Forward Reverse Motor Functional Philosophy

The Forward Reverse DOL start forward output is enabled once all interlocks are ready and a start forward request is received the same for the start reverse request.
Field Interlocks

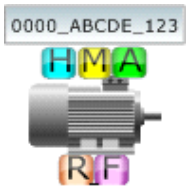
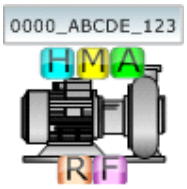
- Trip Feedback
- Fault Feedback

Interlock fault recovery process – once a field interlock is activated the faceplate will display a red indication, if the interlock is recovered and still latched in the PLC function block and the faceplate will show a green indication and the reset button on the faceplate will flash, pressing the Reset button will unlatch the interlock and display a grey indication and allow the DOL to become ready for operation.

Start and stop requests are initiated by selecting a mode on the DOL faceplate:

- **Auto mode** - the auto control program initiates a start and stop, normal PLC control.
- **Manual mode** - the operator can start and stop from the faceplate.
- **Hand mode** - the motor is in PLC bypass mode.

Typical Faceplate Graphics for the Very Basic Forward Reverse DOL Motor MAPS Template

FR DOL ISO	FR DOL Aerator	FR DOL Horizontal Mounted Motor Left	FR DOL PUMP LEFT	FR DOL PUMP RIGHT
				

	Hand Mode
	Manual Mode
	Auto Mode
	Forward
	Reverse
	Motor Control Name

Graphics legend:

Line colour	Fill colour	DOL status
Black	Grey	Stopped
Grey	White	Stopping
Green	White	Starting
Black	Green	Running
Black	Yellow/Red	Fault Active

Signal Description		Agent Type	Very Basic
SCADA Control Words:			
SSCL 0	Control Word	**Marshal**	**x**

Signal Description		Agent Type	Very Basic
SCADA Status Words:			
SSSL 0	Status Word	**Marshal**	**x**
SSSL 1	Total Running Hours	**Analog**	**x**

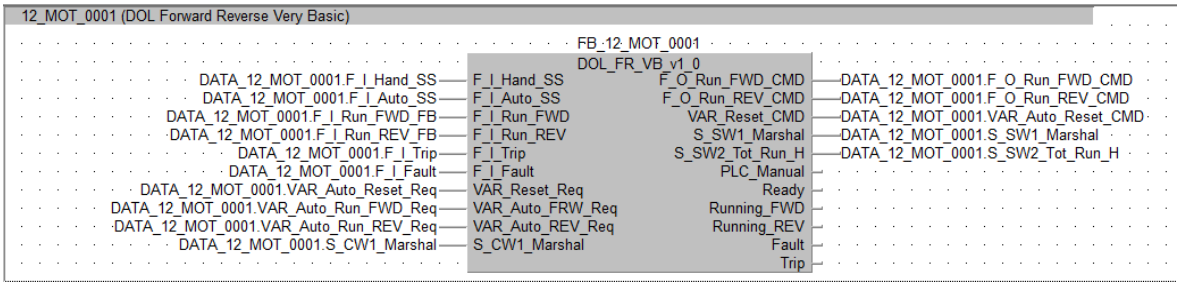
Digital Inputs:		Very Basic
DI 0	Hand (On = Hand)	x
DI 1	Auto (On = Auto)	x
DI 2	Run Forward Feedback (On = Running Forward)	x
DI 3	Run Reverse Feedback (On = Running Reverse)	x
DI 4	Trip (On = Tripped)	x
DI 5	Fault (On = Fault)	x
Digital Outputs:		
DO 0	Device Start Forward	x
DO 1	Device Start Reverse	x

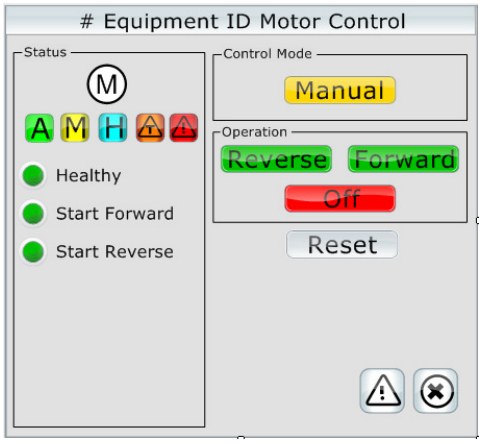
SCADA Control Word (Adroit Marshal Agent)		Event Logged	Very Basic
Bit 0	Alarms All Reset	x	x
Bit 1	Manual	x	x
Bit 2	Start Forward Command	x	x
Bit 3	Start Reverse Command	x	x
Bit 4	Stop Command	x	x
Bit 5	Spare		
Bit 6	Spare		
Bit 7	Spare		
Bit 8	Spare		
Bit 9	Spare		
Bit 10	Spare		
Bit 11	Spare		
Bit 12	Spare		
Bit 13	Spare		
Bit 14	Spare		
Bit 15	Spare		

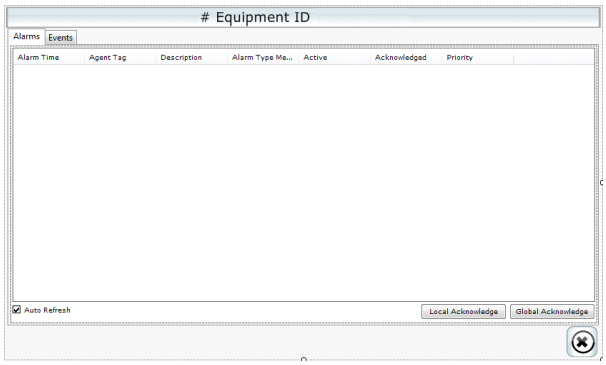
SCADA Status Word (Adroit Marshal Agent)		Alarmed	Very Basic
Bit 0	Hand		x
Bit 1	Auto		x
Bit 2	Manual		x
Bit 3	Ready		x
Bit 4	Starting		x
Bit 5	Running Forward		x
Bit 6	Running Reverse		x
Bit 7	Trip	x	x
Bit 8	Fault	x	x
Bit 9	Spare		
Bit 10	Spare		
Bit 11	Spare		
Bit 12	Spare		
Bit 13	Spare		
Bit 14	Spare		
Bit 15	Spare		

Resources	Very Basic
Digital Inputs	6
Digital Outputs	2
Analog Inputs	0
Analog Outputs	0
PLC Memory Steps	230
System Words Used	9
System Bits Used	76
SCADA SCAN Points	2

Template: Very Basic Forward Reverse DOL PLC Function Block



Template Graphic: Advanced Home Screen	Control	Descriptions
	Manual	Manual control by the operator
	Forward	Manually start Forward the DOL
	Reverse	Manually start Reverse the DOL
	Off	Manually stop the DOL
	Reset	Reset the DOL after a fault has been repaired
	Healthy	Healthy to start the DOL

Template Graphic: Advanced Alarms & Events Screen	Control	Descriptions
	Alarms	Display all the alarms filtered for the current Digital Output
	Events	Display all the events filtered for the current Digital Output.
	Local Acknowledge	Acknowledge all the alarms on locally on the current machine
	Global Acknowledge	Acknowledge all the alarms on globally on all the machines.

14.1.6 Motor (Modbus Variable Speed Drive [VSD]) MAPS Template (Electrical)

The Modbus Variable Speed Drive [VSD] MAPS template is designed to control a motor that is connected to a Mitsubishi VSD on Modbus.
All MAPS templates provide the following:

- an associated PLC function block
- a set of SCADA tags (Adroit agents) linked to the provided signals
- an associated SCADA graphic with inbuilt faceplates

This document describes the Basic Modbus Variable Speed Drive (VSD) Motor MAPS template. For details of its required PLC memory usage; number of PLC I/O and SCADA size (scan points) - see the **Resources** table below.

Modbus VSD Functional Philosophy

The VSD start command output is enabled once all interlocks are ready and a start request is received.
Field Interlocks

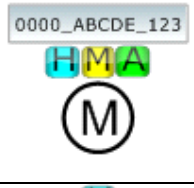
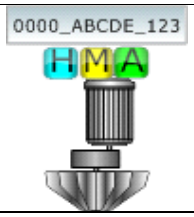
- Trip Feedback
- Fault Feedback

Interlock fault recovery process – once a field interlock is activated the faceplate will display a red indication, if the interlock is recovered and still latched in the PLC function block and the faceplate will show a green indication and the reset button on the faceplate will flash, pressing the Reset button will unlatch the interlock and display a grey indication and allow the Modbus VSD to become ready for operation.

Start and stop requests are initiated by selecting a mode on the Modbus VSD faceplate:

- **Auto mode** - the auto control program initiates a start and stop, for normal PLC control.
- **Manual mode** - the operator can start and stop the motor from the faceplate.
- **Hand mode** - the motor is in PLC bypass mode.

Typical Faceplate Graphics for the Modbus VSD Motor MAPS Template

DOL ISO	DOL Aerator	DOL Standard Pump Side View Left	DOL PUMP LEFT	DOL PUMP RIGHT
				

	Hand Mode
	Manual Mode
	Auto Mode
	Motor Control Name

Graphics legend:

Line colour	Fill colour	DOL status
Black	Grey	Stopped
Grey	White	Stopping
Green	White	Starting
Black	Green	Running
Black	Yellow/Red	Fault Active

Signal Description		Agent Type	Very Basic
SCADA Control Words:			
SSCL 0	Control Word	**Marshal**	**x**
SSCL 1	Speed Set point	**Analog**	**x**

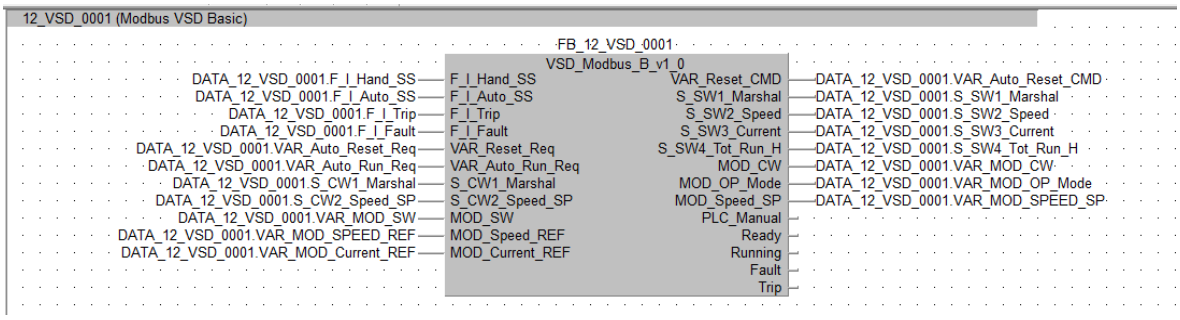
Signal Description		Agent Type	Very Basic
SCADA Status Words:			
SSSL 0	Status Word	**Marshal**	**x**
SSSL 1	Speed Feedback	**Analog**	**x**
SSSL 2	Current Feedback	**Analog**	**x**
SSSL 3	Total Running Hours	**Analog**	**x**

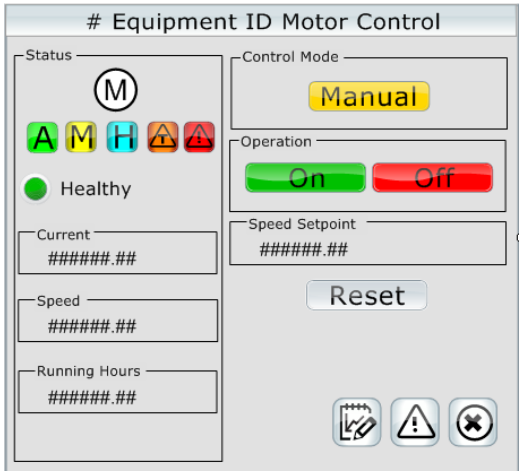
Digital Inputs:		Very Basic
DI 0	Hand (On = Hand)	x
DI 1	Auto (On = Auto)	x
DI 2	Trip (On = Tripped)	x
DI 3	Fault (Off = Fault)	x

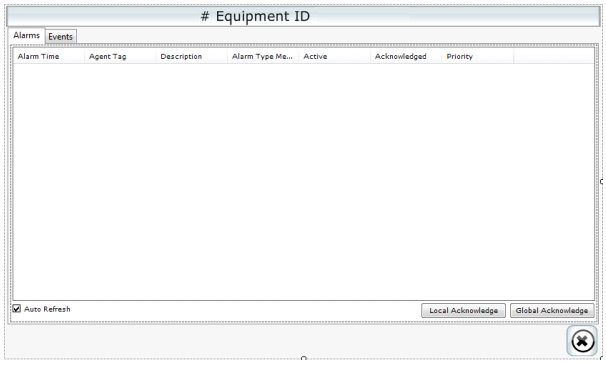
SCADA Control Word (Adroit Marshal Agent)		Event Logged	Very Basic
Bit 0	Alarms All Reset	x	x
Bit 1	Manual	x	x
Bit 2	Start Command	x	x
Bit 3	Stop Command	x	x
Bit 4	Spare		
Bit 5	Spare		
Bit 6	Spare		
Bit 7	Spare		
Bit 8	Spare		
Bit 9	Spare		
Bit 10	Spare		
Bit 11	Spare		
Bit 12	Spare		
Bit 13	Spare		
Bit 14	Spare		
Bit 15	Spare		

SCADA Status Word (Adroit Marshal Agent)		Alarmed	Very Basic
Bit 0	Hand		x
Bit 1	Auto		x
Bit 2	Manual		x
Bit 3	Ready		x
Bit 4	Starting		x
Bit 5	Running		x
Bit 6	Trip	x	x
Bit 7	Fault	x	x
Bit 8	Spare		
Bit 9	Spare		
Bit 10	Spare		
Bit 11	Spare		
Bit 12	Spare		
Bit 13	Spare		
Bit 14	Spare		
Bit 15	Spare		

Resources	Very Basic
Digital Inputs	4
Digital Outputs	0
Analog Inputs	0
Analog Outputs	0
PLC Memory Steps	296
System Words Used	23
System Bits Used	118
SCADA SCAN Points	6

Template: Modbus VSD PLC Function Block


Template Graphic: Home Screen	Control	Descriptions
	Manual	Manual control by the operator
	On	Manually start the DOL
	Off	Manually stop the DOL
	Reset	Reset the DOL after a fault has been repaired
	Healthy	Healthy to start the DOL

Template Graphic: Alarms & Events Screen	Control	Descriptions
	Alarms	Display all the alarms filtered for the current Digital Output
	Events	Display all the events filtered for the current Digital Output.
	Local Acknowledge	Acknowledge all the alarms on locally on the current machine
	Global Acknowledge	**Acknowledge all the alarms on globally on all the machines.**

14.1.7 Motor (Profibus Variable Speed Drive [VSD]) MAPS Template (Electrical)

The Profibus Variable Speed Drive (VSD) Motor MAPS template is designed to control a VSD motor that is connected via a profibus network.

This MAPS template is available in three models – advanced, standard and basic, which provide respectively lower levels of control over the Profibus VSD motor.

This describes the Advanced Profibus VSD Motor MAPS Template and also defines the level of functionality provided by the standard and basic models. So that you can decide which model best suits your needs. You should consider the following factors in your choice:

- the importance of the Profibus VSD motor being controlled and
- the budget of the customer

Since the more complex the model, the greater the required PLC memory usage; number of PLC I/O and SCADA size (scan points) - see the **Resources** table below.

Advanced Profibus VSD Motor Functional Philosophy

The VSD start is enabled once all interlocks are ready and a start request is received.

Field Interlocks

- MCC (Overload) Trip Feedback
- Isolator On Feedback
- Safety Interlock Feedback
- VSD Ready Feedback
- Motor Current Feedback (Current above High Limit Setpoint)

PLC Interlocks

- Start Interlock Ready
- Process Interlock Ready
- Restart Delay Interlock
- There are no interlock faults latched

Motor Current: the motor current is monitored constantly after the running setpoint time has elapsed, if the current goes above the high current limit for five seconds the motor will trip on overcurrent.

Interlock fault recovery process: once a field interlock is activated the faceplate will display a red indication, if the interlock is recovered and still latched in the PLC function block and the faceplate will show a green indication and the reset button on the faceplate will flash, pressing on the reset button will unlatch the interlock and display a grey indication and allow the VSD to become ready for operation.

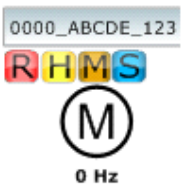
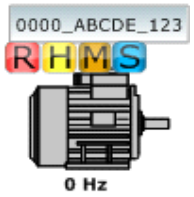
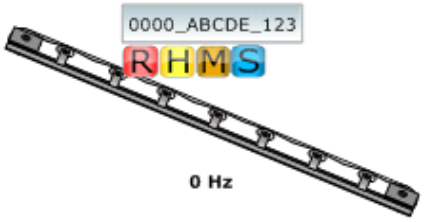
Maintenance mode: disables the Start and Process Interlocks, but respects all the other interlocks. This is used to test a VSD while the process is stopped.

Simulation mode: disables the physical output of the VSD and simulate an input run feedback after the elapsed setpoint time from the faceplate. The Start and Process Interlocks are respected. Simulation mode is used to test the process logic without starting the physical device itself. It is very useful in testing, commissioning and maintenance.

Start and Stop requests: these are initiated by selecting one of the following modes from the VSD faceplate:

- **Auto mode**: the auto control program initiates a start and stop, normal PLC control.
- **Manual mode & Desk mode**: the operator can start and stop from the faceplate.
- **Manual mode & Field mode**: the motor can be started and stopped from the start and stop push buttons in the field.

Typical Faceplate Graphics for the Advanced Profibus VSD Motor MAPS Template

VSD ISO	VSD Motor Left	VSD Pump Left	VSD Conveyor Angle Left
			

H	Manual Mode
M	Maintenance Mode
S	Simulation Mode
F	Running Forward
R	Running Reversed
0 Hz	Current Motor Frequency
0000_ABCDE_123	Motor Control Name

Graphics legend:

Line colour	Fill colour	VSD status
Black	Grey	Stopped
Grey	White	Stopping
Green	White	Starting
Black	Green	Running
Black	Yellow/Red	Fault Active

Signal Description		Agent Type	Advanced	Standard	Basic
SCADA Control Words:					
SSCL 0	Control Word	**Marshal**	**x**	**x**	**X**
SSCL 1	Fail To Start Setpoint	**Analog**	**x**	**x**	**x**
SSCL 2	Fail To Stop Setpoint	**Analog**	**x**	**x**	
SSCL 3	Running Setpoint	**Analog**	**x**	**x**	**x**
SSCL 4	Stopping Setpoint	**Analog**	**x**	**x**	
SSCL 5	Simulate Setpoint	**Analog**	**x**	**x**	**x**
SSCL 6	Restart Setpoint	**Analog**	**x**	**x**	
SSCL 7	Max Current Setpoint (High Limit)	**Analog**	**x**	**x**	**x**
SSCL 8	Frequency Setpoint	**Analog**	**x**	**x**	**x**
SSCL 9	Parameter Read/Write Number	**Analog**	**x**		
SSCL 10	Parameter Read/Write Value	**Analog**	**x**		
Signal Description		**Agent Type**	**Advanced**	**Standard**	**Basic**
SCADA Status Words:					
SSSL 0	Status Word	**Marshal**	**x**	**x**	**x**
SSSL 1	Starting Time Process Value (actual)	**Analog**	**x**	**x**	**x**
SSSL 2	Stopping Time Process Value (actual)	**Analog**	**x**	**x**	
SSSL 3	No of Operations (actual)	**Analog**	**x**	**x**	
SSSL 4	Restart Delay Time Remaining (actual)	**Analog**	**x**	**x**	
SSSL 5	Motor Current Process Value (actual)	**Analog**	**x**	**x**	**x**
SSSL 6	Total Running Hours	**Analog**	**x**		
SSSL 7	VSD Status Word	**Marshal**	**x**	**x**	**x**
SSSL 8	Output Frequency	**Analog**	**x**	**x**	**x**
SSSL 9	VSD Alarm Code	**Analog**	**x**		

Digital Inputs:		Advanced	Standard	Basic
DI 0	Running Signal (On = Healthy)	**x**		
DI 1	Isolator Healthy (On = Healthy)	**x**	**x**	**x**
DI 2	MCC Healthy (On = Healthy)	**x**	**x**	**x**
DI 3	Safety Interlock Healthy (On = Healthy)	**x**	**x**	
DI 4	Manual Forward Start Push Button (On = Start)	**x**	**x**	
DI 5	Manual Reverse Start Push Button (On = Start)	**x**	**x**	
DI 6	Manual Stop Push Button (Off = Stop)	**x**		
Intelligent Module Control/Status Words (PPO2)				
10	Control Words	**x**	**x**	**x**
10	Status Words	**x**	**x**	**x**

SCADA Control Word (Adroit Marshal Agent)		Event Logged	Advanced	Standard	Basic
Bit 0	Auto/Manual	**x**	**x**	**x**	**x**
Bit 1	Field/Desk	**x**	**x**	**x**	**x**
Bit 2	Maintenance	**x**	**x**	**x**	**x**
Bit 3	Simulation	**x**	**x**	**x**	**x**
Bit 4	Alarms All Reset		**x**	**x**	**x**

Bit 5	Reset No Operations Accumulator	x	x	x	
Bit 6	Start Command	x	x	x	x
Bit 7	Reset Running Hours Accumulator	x	x		
Bit 8	Stop Command	x	x	x	x
Bit 9	External Control	x	x	x	x
Bit 10	Start Forward	x	x	x	x
Bit 11	Start Reverse	x	x	x	x
Bit 12	Read Parameter		x		
Bit 13	Write Parameter		x		
Bit 14	VSD Alarm Reset		x		
Bit 15	Spare				

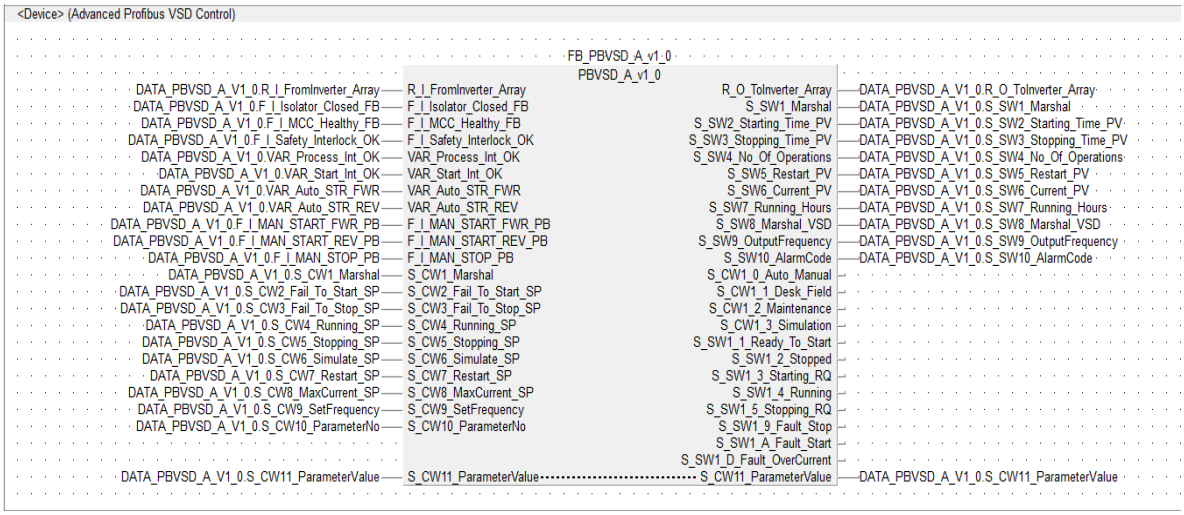
SCADA Status Word (Adroit Marshal Agent)		Alarmed	Advanced	Standard	Basic
Bit 0	Process Interlock		x	x	x
Bit 1	Ready To Start		x	x	x
Bit 2	Stopped		x	x	x
Bit 3	Starting		x	x	x
Bit 4	Running		x	x	x
Bit 5	Stopping		x	x	x
Bit 6	Fault		x	x	x
Bit 7	Start Interlock OK		x	x	x
Bit 8	Isolator Closed Fault	x	x		
Bit 9	Fault Fail To Stop	x	x	x	
Bit 10	Fault Fail To Start	x	x	x	x
Bit 11	MCC Fault	x	x	x	x
Bit 12	Safety Fault	x	x	x	x
Bit 13	Overcurrent Fault	x	x	x	x
Bit 14	Spare				
Bit 15	Spare				

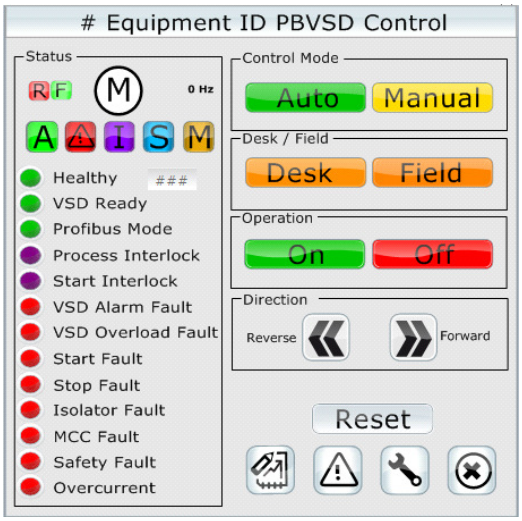
SCADA Status Word1 (Adroit Marshal Agent)		Alarmed	Advanced	Standard	Basic
Bit 0	VSD Running Feedback		x	x	x
Bit 1	VSD Alarm Active	x	x	x	x
Bit 2	VSD Command Error	x	x	x	x
Bit 3	VSD Profibus Mode		x	x	x
Bit 4	VSD Busy		x	x	x
Bit 5	VSD Ready		x	x	x
Bit 6	VSD Overload Fault	x	x	x	x
Bit 7	Spare				
Bit 8	Spare				
Bit 9	Spare				
Bit 10	Spare				
Bit 11	Spare				
Bit 12	Spare				

Bit 13	Spare				
Bit 14	Spare				
Bit 15	Spare				

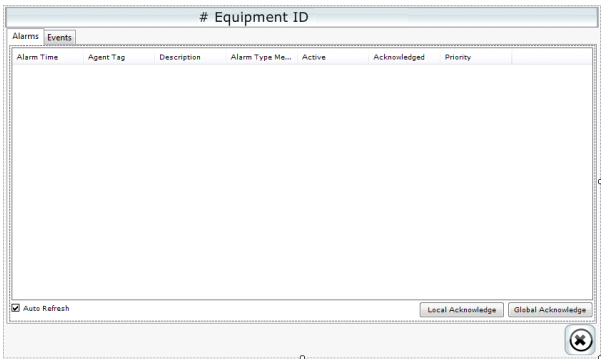
Resources	Advanced	Standard	Basic
Digital Inputs	6	5	2
Digital Outputs	0	0	0
Analog Inputs	0	0	0
Analog Outputs	0	0	0
PLC Memory Steps	871	823	747
System Words Used	84	78	65
System Bits Used	204	198	187
SCADA SCAN Points	21	17	11

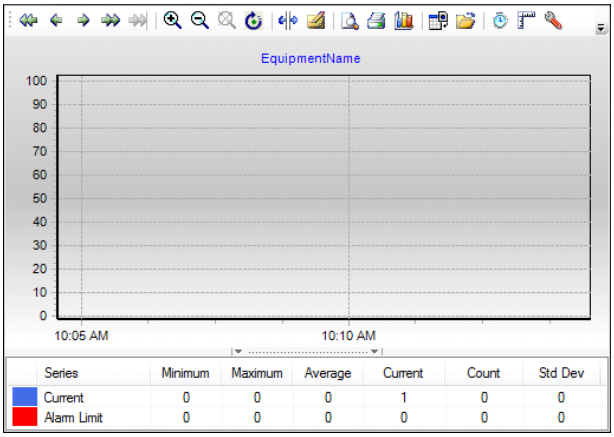
Template: Advanced Profibus VSD PLC Function Block



Template Graphic: Advanced Home Screen	Control	Descriptions
	Auto	Auto control by PLC
	Manual	Manual control by operator, desk and field mode
	Desk	Manual control from the SCADA faceplate
	Field	Manual control from the field start/stop station
	On	Manual start the VSD
	Off	Manual stop the VSD
	Reset	Reset the VSD after a fault has been repaired
	Healthy ###	Healthy to start, ### - Restart delay countdown in
	Process Interlock	VSD process ok to run interlock ready
	Start Interlock	VSD ok to start interlock ready
	Start Fault	VSD failed to start fault
	Stop Fault	VSD failed to stop fault
	Isolator Fault	VSD isolator off fault
	MCC Fault	VSD MCC tripped fault
	Safety Fault	VSD Safety off fault
	Overcurrent	VSD overcurrent fault

Template Graphic: Advanced Setup Screen	Control	Descriptions
	Simulate	Enable simulation of VSD, disables the physical output
	Feedback Time	Time for simulation to simulate run feedback signal
	Maintenance	Enable maintenance mode (Disables all interlocks)
	Number of operations	Total number of VSD start operations
	Running Hours	Total number of VSD running hours
	Reset	Reset the total counter of the current service
	Start Signal Delay (SP)	Delay the PLC to accept the VSD is running
	Max Start (SP)	Time for running signal is on after start signal is on
	Last Start (PV)	Last time for running signal was on after start signal was on
	Stop Signal Delay (SP)	Delay the PLC to accept the VSD is stopped
	Max Stop (SP)	Time running signal is off after start signal is off
	Last Stop (PV)	Last time running signal was off after start signal was off
	Current Hi Limit	Sets the value of the maximum current for the VSD to trip at
	Current Value	Actual current the VSD is running at
	Frequency SP	Frequency setpoint for VSD
	Par. No	Number of parameter to be modified.
	Parameter Value	Value of parameter that is modified
	Alarm Code	VSD alarm fault code. (see manual for descriptions)
	Restart (SP)	Restart prevention time of the VSD setpoint
	Restart (PV)	Remaining time before a VSD restart is allowed

Template Graphic: Advanced Alarms & Events Screen	Control	Descriptions
	Alarms	Display all the alarms filtered for the current Digital Output
	Events	Display all the events filtered for the current Digital Output.
	Local Acknowledge	Acknowledge all the alarms on locally on the current machine
	Global Acknowledge	Acknowledge all the alarms on globally on all the machines.

Template Graphic: Advanced Trend Screen	Control	Descriptions
	Current	Display the current of the VSD in the trend, with minimum, maximum and average values.
	Alarm Limit	Display the current Setpoint of alarming on high current of the VSD in the trend, with minimum, maximum and average values.

14.1.8 Motor (Variable Speed Drive [VSD]) MAPS Template (Electrical)

The Variable Speed Drive (VSD) Motor MAPS template is designed to control a VSD motor that is connected by five outputs one for forward direction and one for reverse direction and three for the speed selection.

This describes the Advanced Variable Speed Drive (VSD) Motor MAPS Template. For details of its required PLC memory usage; number of PLC I/O and SCADA size (scan points) - see the **Resources** table below.

Advanced VSD Motor Functional Philosophy

The VSD start forward and reverse direction outputs are enabled once all interlocks are ready and a start request is received.

Field Interlocks

- MCC (Overload) Trip Feedback
- Isolator On Feedback
- Safety Interlock Feedback
- Motor Current Feedback (Analog Input) (Current above High Limit Setpoint)

PLC Interlocks

- Start Interlock Ready
- Process Interlock Ready
- Restart Delay Interlock
- There are no interlock faults latched

Motor Current: the motor current is monitored constantly after the running setpoint time has elapsed, if the current goes above the high current limit for five seconds the motor will trip on overcurrent.

Interlock fault recovery process: once a field interlock is activated the faceplate will display a red indication, if the interlock is recovered and still latched in the PLC function block and the faceplate will show a green indication and the reset button on the faceplate will flash, pressing on the reset button will unlatch the interlock and display a grey indication and allow the VSD to become ready for operation.

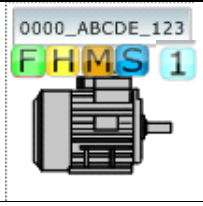
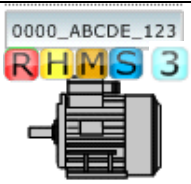
Maintenance mode: disables the Start and Process Interlocks, but respects all the other interlocks. This is used to test a VSD while the process is stopped.

Simulation mode: disables the physical output of the VSD and simulate an input run feedback after the elapsed setpoint time from the faceplate. The Start and Process Interlocks are respected. Simulation mode is used to test the process logic without starting the physical device itself. It is very useful in testing, commissioning and maintenance.

Start and Stop requests: these are initiated by selecting one of the following modes from the VSD faceplate:

- **Auto mode**: the auto control program initiates a start and stop, normal PLC control.
- **Manual mode & Desk mode**: the operator can start and stop from the faceplate.
- **Manual mode & Field mode**: the motor can be started and stopped from the start and stop push buttons in the field.

Typical Faceplate Graphics for the Advanced VSD Motor MAPS Template

VSD ISO	VSD MOTOR LEFT	VSD MOTOR RIGHT	VSD PUMP LEFT	VSD PUMP RIGHT
				

R	VSD Reverse Direction Indication
F	VSD Forward Direction Indication
1	VSD Speed 01 Selected Indication
2	VSD Speed 02 Selected Indication
3	VSD Speed 03 Selected Indication
H	Manual Mode
M	Maintenance Mode
S	Simulation Mode
0000_ABCDE_123	Motor Control Name

Graphics legend:

Line colour	Fill colour	VSD status
Black	Grey	Stopped
Grey	White	Stopping
Green	White	Starting
Black	Green	Running
Black	Yellow/Red	Fault Active

Signal Description		Agent Type	Advanced	Standard	Basic
SCADA Control Words:					
SSCL 0	Control Word	**Marshal**	**x**		
SSCL 1	Fail To Start Setpoint	**Analog**	**x**		
SSCL 2	Fail To Stop Setpoint	**Analog**	**x**		
SSCL 3	Running Setpoint	**Analog**	**x**		
SSCL 4	Stopping Setpoint	**Analog**	**x**		
SSCL 5	Simulate Setpoint	**Analog**	**x**		
SSCL 6	Restart Setpoint	**Analog**	**x**		
SSCL 7	Max Current Setpoint (High Limit)	**Analog**	**x**		
SSCL 8	Min In Current Setpoint (Raw Min)	**Analog**	**x**		
SSCL 9	Max In Current Setpoint (Raw Max)	**Analog**	**x**		
SSCL 10	Min Out Current Setpoint (Eng. Min)	**Analog**	**x**		
SSCL 11	Max Out Current Setpoint (Eng. Min)	**Analog**	**x**		
SSSL 0	Status Word	**Marshal**	**x**		
SSSL 1	Starting Time Process Value (actual)	**Analog**	**x**		
SSSL 2	Stopping Time Process Value (actual)	**Analog**	**x**		
SSSL 3	No of Operations (actual)	**Analog**	**x**		
SSSL 4	Restart Delay Time Remaining (actual)	**Analog**	**x**		
SSSL 5	Motor Current Process Value (actual)	**Analog**	**x**		
SSSL 6	Total Running Hours	**Analog**	**x**		
SSSL 7	Status Word 2	**Marshal**	**x**		

Digital Inputs:		Advanced	Standard	Basic
DI 0	VSD Running Signal (On = Healthy)	**x**		
DI 1	Isolator Healthy (On = Healthy)	**x**		
DI 2	MCC Healthy (On = Healthy)	**x**		
DI 3	Safety Interlock Healthy (On = Healthy)	**x**		
DI 4	Manual Start Push Button Forward (On = Start)	**x**		
DI 5	Manual Start Push Button Reverse (On = Start)	**x**		
DI 6	Manual Stop Push Button (Off = Stop)	**x**		
Digital Outputs:				
DO 0	Device Start Forward	**x**		
DO 1	Device Start Reverse	**x**		
DO 2	Device Speed 01 Signal	**x**		
DO 3	Device Speed 02 Signal	**x**		
DO 4	Device Speed 03 Signal	**x**		

Analog Input:				
AI 0	Analog Input for Current Drawn	x		

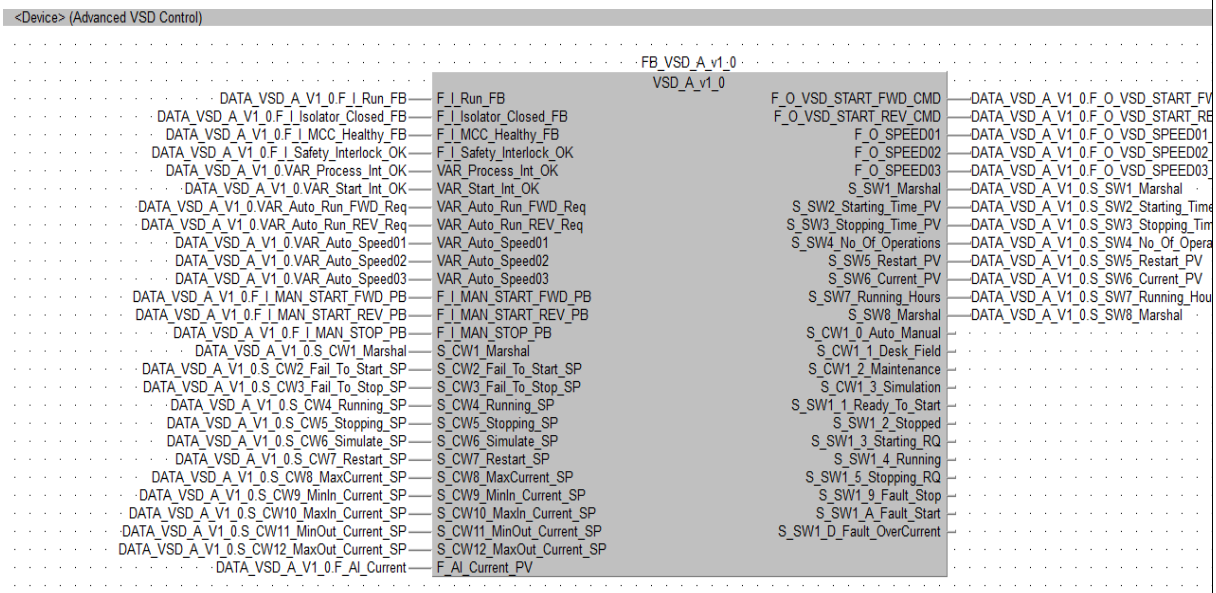
SCADA Control Word (Adroit Marshal Agent)		Event Logged	Advanced	Standard	Basic
Bit 0	Auto/Manual	x	x		
Bit 1	Field/Desk	x	x		
Bit 2	Maintenance	x	x		
Bit 3	Simulation	x	x		
Bit 4	Alarms All Reset		x		
Bit 5	Reset No Operations Accumulator	x	x		
Bit 6	Start Command	x	x		
Bit 7	Reset Running Hours Accumulator	x	x		
Bit 8	Stop Command	x	x		
Bit 9	Speed 01 Enabled	x	x		
Bit 10	Speed 02 Enabled	x	x		
Bit 11	Speed 03 Enabled	x	x		
Bit 12	Spare				
Bit 13	Spare				
Bit 14	Forward Command	x	x		
Bit 15	Reverse Command	x	x		

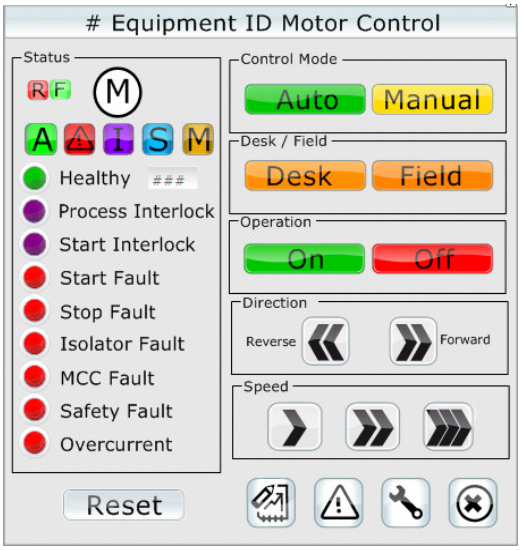
SCADA Status Word (Adroit Marshal Agent)		Alarmed	Advanced	Standard	Basic
Bit 0	Process Interlock		x		
Bit 1	Ready To Start		x		
Bit 2	Stopped		x		
Bit 3	Starting		x		
Bit 4	Running		x		
Bit 5	Stopping		x		
Bit 6	Fault		x		
Bit 7	Start Interlock OK		x		
Bit 8	Isolator Closed Fault	x	x		
Bit 9	Fault Fail To Stop	x	x		
Bit 10	Fault Fail To Start	x	x		
Bit 11	MCC Fault	x	x		
Bit 12	Safety Fault	x	x		
Bit 13	Overcurrent Fault	x	x		
Bit 14	Spare				
Bit 15	Forward Reverse Status Indication		x		
SCADA Status Word 2 (Adroit Marshal Agent)		**Alarmed**	**Advanced**	**Standard**	**Basic**
Bit 0	Speed 01 Active	x	x		
Bit 1	Speed 02 Active	x	x		
Bit 2	Speed 03 Active	x	x		
Bit 3	Spare				
Bit 4	Spare				
Bit 5	Spare				

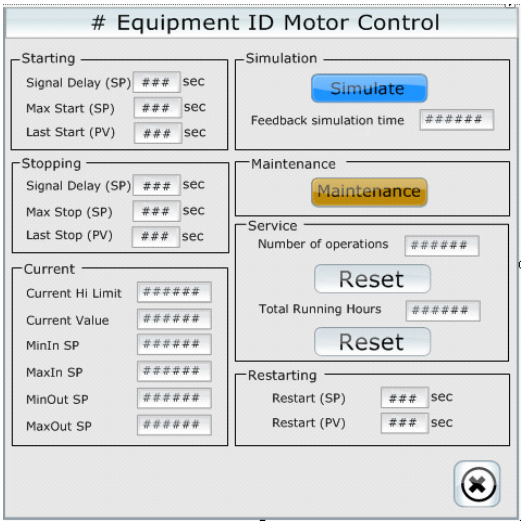
Bit 6	Spare				
Bit 7	Spare				
Bit 8	Spare				
Bit 9	Spare				
Bit 10	Spare				
Bit 11	Spare				
Bit 12	Spare				
Bit 13	Spare				
Bit 14	Spare				
Bit 15	Spare				

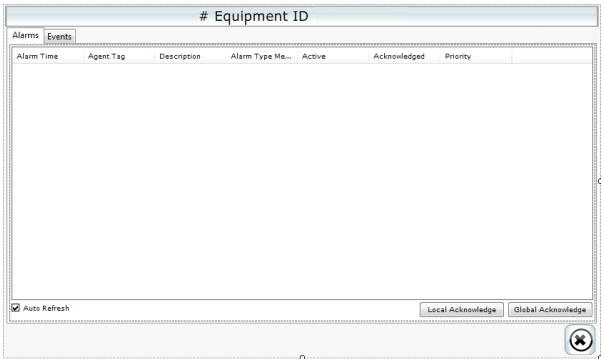
Resources	Advanced	Standard	Basic
Digital Inputs	7		
Digital Outputs	5		
Analog Inputs	1		
Analog Outputs	0		
PLC Memory Steps	643		
System Words Used	74		
System Bits Used	178		
SCADA SCAN Points	20		

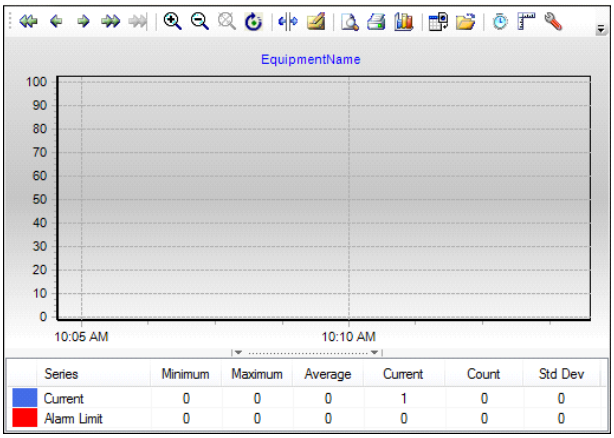
Template: Advanced VSD PLC Function Block



Template Graphic: Advanced Home Screen	Control	Descriptions
	Auto	Auto control by PLC
	Manual	Manual control by operator, desk and field mode
	Desk	Manual control from the SCADA faceplate
	Field	Manual control from the field start/stop station
	On	Manual start the VSD
	Off	Manual stop the VSD
	Reset	Reset the VSD after a fault has been repaired
	Healthy ###	Healthy to start, Restart delay countdown in seconds
	Process Interlock	VSD process ok to run interlock ready
	Start Interlock	VSD ok to start interlock ready
	Start Fault	VSD failed to start fault
	Stop Fault	VSD failed to stop fault
	Isolator Fault	VSD isolator off fault
	MCC Fault	VSD MCC tripped fault
	Safety Fault	VSD Safety off fault
	Overcurrent	VSD overcurrent fault
	Reverse	VSD reverse direction selection and indication
	Forward	VSD forward direction selection and indication VSD
	Speed	VSD speed 1 to 3 selection and indication

Template Graphic: Advanced Setup Screen	Control	Descriptions
	Simulate	Enable simulation of VSD, disables the physical output
	Feedback Time	Time for simulation to simulate run feedback signal
	Maintenance	Enable maintenance mode (Disables all interlocks)
	Number of operations	Total number of VSD start operations
	Running Hours	Total number of VSD running hours
	Reset	Reset the total counter of the current service
	Start Signal Delay (SP)	Delay the PLC to accept the VSD is running
	Max Start (SP)	Time for running signal is on after start signal is on
	Last Start (PV)	Last time for running signal was on after start signal was on
	Stop Signal Delay (SP)	Delay the PLC to accept the VSD is stopped
	Max Stop (SP)	Time running signal is off after start signal is off
	Last Stop (PV)	Last time running signal was off after start signal was off
	Current Hi Limit	Sets the value of the maximum current for the VSD to trip at
	Current Value	Actual current the VSD is running at
	Frequency SP	Frequency setpoint for VSD
	Par. No	Number of parameter to be modified.
	Parameter Value	Value of parameter that is modified
	Alarm Code	VSD alarm fault code. (see manual for descriptions)
	Restart (SP)	Restart prevention time of the VSD setpoint
	Restart (PV)	Remaining time before a VSD restart is allowed

Template Graphic: Advanced Alarms & Events Screen	Control	Descriptions
	Alarms	Display all the alarms filtered for the current Digital Output
	Events	Display all the events filtered for the current Digital Output.
	Local Acknowledge	Acknowledge all the alarms on locally on the current machine
	Global Acknowledge	Acknowledge all the alarms on globally on all the machines.

Template Graphic: Advanced Trend Screen	Control	Descriptions
	Current	Display the current of the VSD in the trend, with minimum, maximum and average values.
	Alarm Limit	Display the current Setpoint of alarming on high current of the VSD in the trend, with minimum, maximum and average values.

14.1.9 Valve (Control) MAPS Template (Electrical)

The Control Valve MAPS template is designed to control a valve that has an analog output with an analog feedback and two end limit switches.

This describes the Advanced Control Valve MAPS Template. For details of its required PLC memory usage; number of PLC I/O and SCADA size (scan points) - see the **Resources** table below.

Advanced Control Valve Functional Philosophy

The valve open analog output is enabled once all interlocks are ready and an open request is received.

Field Interlocks

- Safety Interlock Feedback

PLC Interlocks

- Process Interlock Ready
- There are no interlock faults latched

Interlock fault recovery process: once a field interlock is activated the face plate will display a red indication, if the interlock is recovered and still latched the faceplate will show a green indication and the reset button on the faceplate will flash, pressing on the reset button will unlatch the interlock and display a grey indication and allow the Valve to become ready for operation.

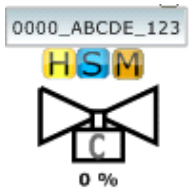
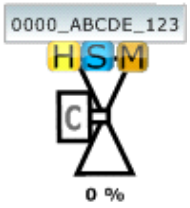
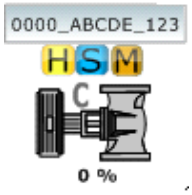
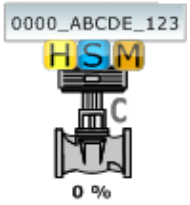
Maintenance mode: disables the Process Interlocks, but respects all the other interlocks. This is used to test a Valve while the process is closed.

Simulation mode: disables the physical outputs of the Valve and simulate an input limit feedback after the elapsed setpoint time from the faceplate. The Process Interlocks are respected. Simulation mode is used to test the process logic without opening the physical Valve itself. It is very useful in commissioning and maintenance.

Open and Close requests: these are initiated by selecting one of the following modes from the valve faceplate:

- **Auto mode**: the auto control program initiates an Open and Close.
- **Manual mode & Desk mode**: the operator initiates an Open and Close from the faceplate.
- **Manual mode & Field mode**: the operator initiates an Open and Close from the Open and Close push buttons in the field.

Typical Faceplate Graphics for the Advanced Control Valve MAPS Template

Valve ISO DOWN	Valve ISO RIGHT	Valve LEFT	Valve TOP
			

H	Manual Mode
M	Maintenance Mode
S	Simulation Mode
0000_ABCDE_123	Valve Control / Tag Name

Graphics legend:		
Line colour	**Fill colour**	**Valve status**
Black	Grey	Closed
Grey	White	Closing
Green	White	Opening
Black	Green	Opened
Black	Yellow/Red	Fault active

Signal Description		**Agent Type**	**Advanced**	**Standard**	**Basic**
SCADA Control Words:					
SSCL 0	Control Word	**Marshal**	**x**		
SSCL 1	Fail to Open Setpoint	**Analog**	**x**		
SSCL 2	Fail to Close Setpoint	**Analog**	**x**		
SSCL 3	Simulate Setpoint	**Analog**	**x**		
SSCL 4	Opened Delay Setpoint	**Analog**	**x**		
SSCL 5	Closed Delay Setpoint	**Analog**	**x**		
SSCL 6	Manual Setpoint	**Analog**	**x**		
SSCL 7	Hysteresis Setpoint	**Analog**	**x**		
SSCL 8	Minimum Raw Setpoint	**Analog**	**x**		
SSCL 9	Maximum Raw Setpoint	**Analog**	**x**		
SSCL 10	Minimum Engineering Setpoint	**Analog**	**x**		
SSCL 11	Maximum Engineering Setpoint	**Analog**	**x**		

Signal Description		Agent Type	Advanced	Standard	Basic
SCADA Status Words:					
SSSL 0	Status Word	**Marshal**	**x**		
SSSL 1	Last Opened Time Process Value	**Analog**	**x**		
SSSL 2	Last Closed Time Process Value	**Analog**	**x**		
SSSL 3	Number of Operations	**Analog**	**x**		
SSSL 4	Valve Current Process Value	**Analog**	**x**		

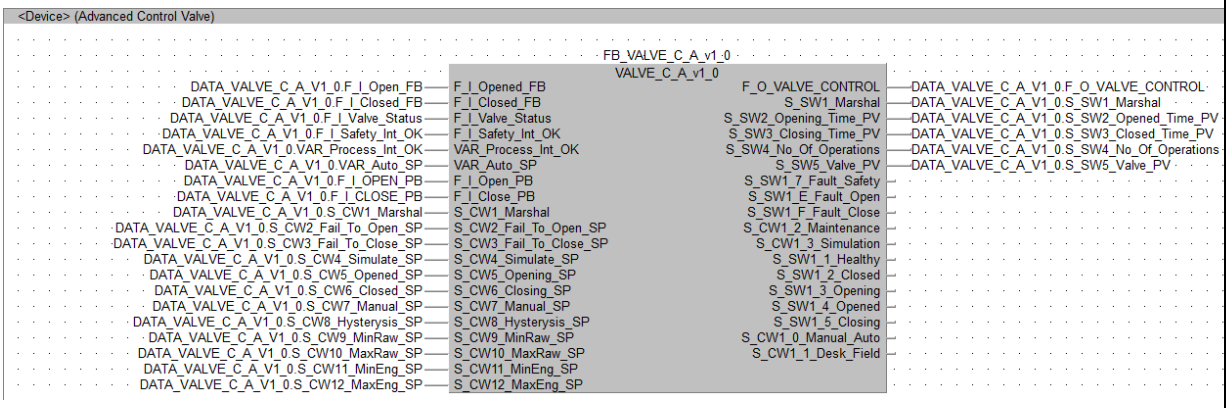
Digital Inputs:		Advanced	Standard	Basic
DI 0	Open Limit Feedback	**x**		
DI 1	Closed Limit Feedback	**x**		
DI 2	Safety Interlock Ok	**x**		
DI 3	Open Push Button	**x**		
DI 4	Close Push Button	**x**		
Analog Input:				
AI 0	Valve Open Analog Status	**x**		
Analog Output:				
AO 0	Valve Open Analog Command	**x**		

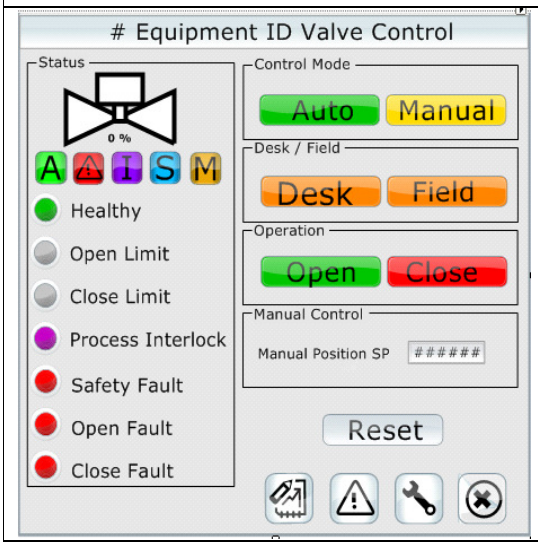
SCADA Control Word (Adroit Marshal Agent)		Event Logged	Advanced	Standard	Basic
Bit 0	Auto Manual	**x**	**x**		
Bit 1	Field Desk	**x**	**x**		
Bit 2	Maintenance	**x**	**x**		
Bit 3	Simulation	**x**	**x**		
Bit 4	Reset Fault	**x**	**x**		
Bit 5	Reset Number of Operations	**x**	**x**		
Bit 6	Open Request	**x**	**x**		
Bit 7	Spare				
Bit 8	Close Request	**x**	**x**		
Bit 9	Spare				
Bit 10	Spare				
Bit 11	Spare				
Bit 12	Spare				
Bit 13	Spare				
Bit 14	Spare				
Bit 15	Spare				

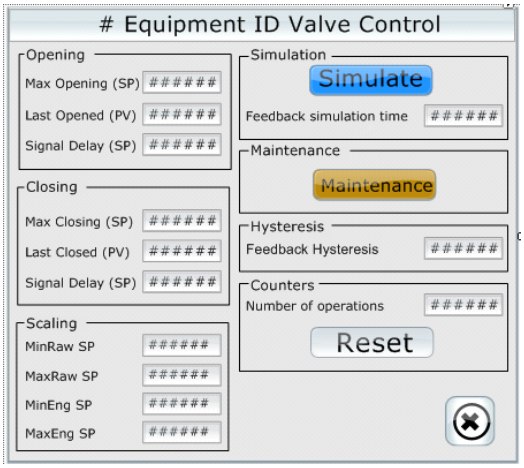
SCADA Status Word (Adroit Marshal Agent)		Alarmed	Advanced	Standard	Basic
Bit 0	Process Interlock Ok		x		
Bit 1	Valve Healthy		x		
Bit 2	Closed		x		
Bit 3	Opening		x		
Bit 4	Opened		x		
Bit 5	Closing		x		
Bit 6	Fault		x		
Bit 7	Safety Fault	x	x		
Bit 8	Spare				
Bit 9	Spare				
Bit 10	Spare				
Bit 11	Spare				
Bit 12	Open FB		x		
Bit 13	Closed FB		x		
Bit 14	Fault Open	x	x		
Bit 15	Fault Close	x	x		

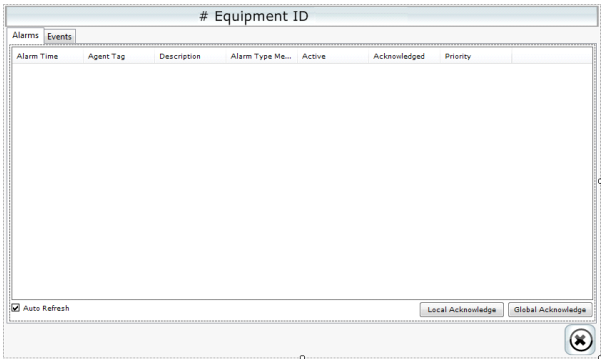
Resources	Advanced	Standard	Basic
Digital Inputs	5		
Digital Outputs	2		
Analog Inputs	1		
Analog Outputs	1		
PLC Memory Steps	651		
System Words Used	83		
System Bits Used	97		
SCADA SCAN Points	17		

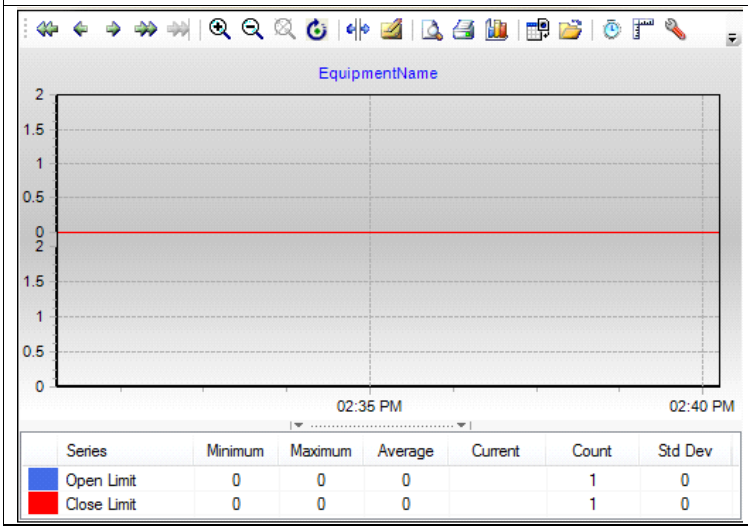
Template: Advanced Control Valve PLC Function Block



Template Graphic: Advanced Home Screen	Control	Description
	Auto	Auto control by PLC
	Manual	Manual control by operator, desk and field mode
	Desk	Manual control from the SCADA faceplate
	Field	Manual control from the field Open/Close station
	Open	Manual open the Valve
	Close	Manual close the Valve
	######	Manual Open Position Setpoint Value
	Reset	Reset the Valve after a fault has been repaired
	Healthy	Healthy to Open
	Open Limit	Valve opened limit input
	Close Limit	Valve closed limit input
	Process Interlock	Valve process ok to open interlock ready
	Safety Fault	Valve safety off fault
	Open Fault	Valve failed to open fault
	Close Fault	Valve failed to close fault

Template Graphic: Advanced Setup Screen	Control	Description
	Simulate	Enable simulation of Valve, disables the physical outputs
	Feedback Time	Time for simulation to simulate open/close feedback signals
	Maintenance	Enable maintenance mode (Disables all interlocks)
	Number of operations	Total number of valve open operations
	Reset	Reset the total number of valve open operations
	Open Signal Delay (SP)	Delay the PLC to accept the valve is open
	Max Opening (SP)	Time for the valve to fail to open
	Last Opened (PV)	Last time the valve taken to open
	Close Signal Delay (SP)	Delay the PLC to accept the valve is close
	Max Closing (SP)	Time for the valve to fail to close
	Last Closed (PV)	Last time the valve taken to close
	Feedback Hysteresis	Analog feedback in range hysteresis setpoint
	MinRaw / MaxRaw	Raw minimum and maximum scaling setpoints
	MinEng / MaxEng	Engineering minimum and maximum scaling setpoints

Template Graphic: Advanced Alarms & Events Screen	Control	Descriptions
	Alarms	Display all the alarms filtered for the current Digital Output
	Events	Display all the events filtered for the current Digital Output.
	Local Acknowledge	Acknowledge all the alarms on locally on the current machine
	Global Acknowledge	Acknowledge all the alarms on globally on all the machines.

Template Graphic: Advanced Trend Screen	Control	Description
	Equipment Name	Display the current valve name of the trend.
	Open limit	Display the status of the open limit of the valve
	Close Limit	Display the status of the close limit of the valve

14.1.10 Valve (Single Actuating) MAPS Template (Electrical)

The Single Actuating Valve MAPS template is designed to control a valve that has one solenoid and two limit switches.

This MAPS template is available in three models – advanced, standard and basic, which provide respectively lower levels of control over the valve.

This describes the Advanced Single Actuating Valve MAPS Template and also defines the level of functionality provided by the standard and basic models. So that you can decide which model best suits your needs. You should consider the following factors in your choice:

- the importance of the valve being controlled and
- the budget of the customer

Since the more complex the model, the greater the required PLC memory usage; number of PLC I/O and SCADA size (scan points) - see the **Resources** table below.

Advanced Single Actuating Valve Functional Philosophy

The valve open output is enabled once all interlocks are ready and an open request is received.

Field Interlocks

- Safety Interlock Feedback

PLC Interlocks

- Process Interlock Ready
- There are no interlock faults latched

Interlock fault recovery process: once a field interlock is activated the face plate will display a red indication, if the interlock is recovered and still latched the faceplate will show a green indication and the reset button on the faceplate will flash, pressing on the reset button will unlatch the interlock and display a grey indication and allow the Valve to become ready for operation.

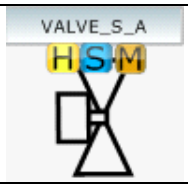
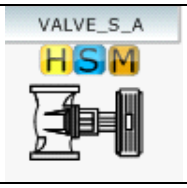
Maintenance mode: disables the Process Interlocks, but respects all the other interlocks. This is used to test a Valve while the process is closed.

Simulation mode: disables the physical outputs of the Valve and simulate an input limit feedback after the elapsed setpoint time from the faceplate. The Process Interlocks are respected. Simulation mode is used to test the process logic without opening the physical Valve itself. It is very useful in commissioning and maintenance.

Open and Close requests: these are initiated by selecting one of the following modes from the valve faceplate:

- **Auto mode**: the auto control program initiates an Open and Close.
- **Manual mode & Desk mode**: the operator initiates an Open and Close from the faceplate.
- **Manual mode & Field mode**: the operator initiates an Open and Close from the Open and Close push buttons in the field.

Typical Faceplate Graphics for the Advanced Single Actuating Valve MAPS Template

Valve ISO DOWN	Valve ISO RIGHT	Valve LEFT	Valve TOP
			
H	Manual Mode		
M	Maintenance Mode		
S	Simulation Mode		
0000_ABCDE_123	Valve Control / Tag Name		

Graphics legend:		
Line colour	**Fill colour**	**Valve status**
Black	Grey	Closed
Grey	White	Closing
Green	White	Opening
Black	Green	Opened
Black	Yellow/Red	Fault active

Signal Description		**Agent Type**	**Advanced**	**Standard**	**Basic**
SCADA Control Words:					
SSCL 0	Control Word	**Marshal**	**x**	**x**	**x**
SSCL 1	Fail to Open Setpoint	**Analog**	**x**	**x**	**x**
SSCL 2	Fail to Close Setpoint	**Analog**	**x**	**x**	**x**
SSCL 3	Simulate Setpoint	**Analog**	**x**	**x**	
SSCL 4	Opened Delay Setpoint	**Analog**	**x**		
SSCL 5	Closed Delay Setpoint	**Analog**	**x**		

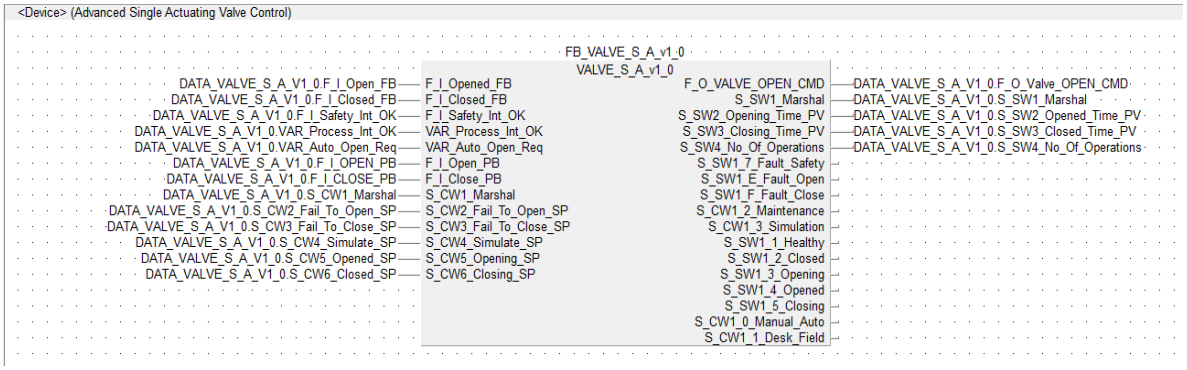
Signal Description		Agent Type	Advanced	Standard	Basic
SCADA Status Words:					
SSSL 0	Status Word	**Marshal**	**x**	**x**	**x**
SSSL 1	Last Opened Time Process Value	**Analog**	**x**	**x**	
SSSL 2	Last Closed Time Process Value	**Analog**	**x**	**x**	
SSSL 3	Number of Operations	**Analog**	**x**	**x**	

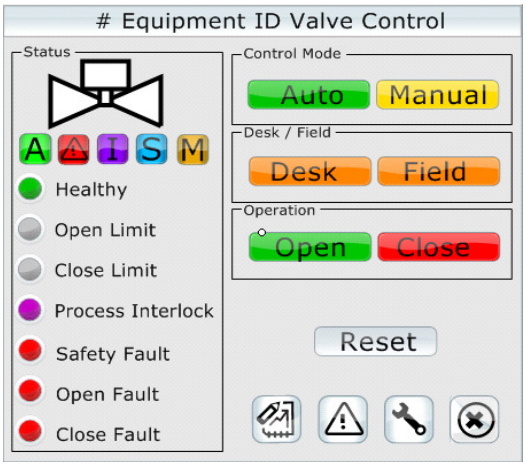
Digital Inputs:		Advanced	Standard	Basic
DI 0	Open Limit Feedback	**x**	**x**	**x**
DI 1	Closed Limit Feedback	**x**	**x**	**x**
DI 2	Safety Interlock Ok	**x**		
DI 3	Open Push Button	**x**		
DI 4	Close Push Button	**x**		
Digital Outputs:				
DO 0	Valve Open Solenoid Command	**x**	**x**	**x**

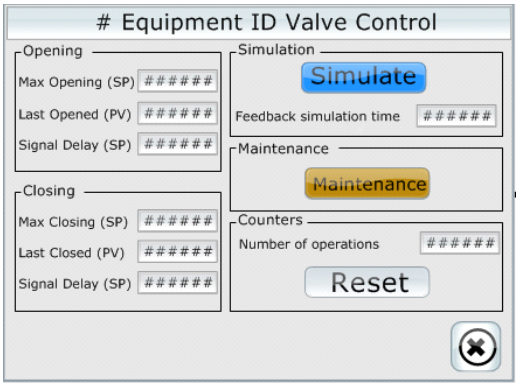
SCADA Control Word (Adroit Marshal Agent)		Event Logged	Advanced	Standard	Basic
Bit 0	Auto Manual	**x**	**x**	**x**	**x**
Bit 1	Field Desk	**x**	**x**	**x**	**x**
Bit 2	Maintenance	**x**	**x**	**x**	**x**
Bit 3	Simulation	**x**	**x**	**x**	
Bit 4	Reset Fault	**x**	**x**	**x**	**x**
Bit 5	Reset Number of Operations	**x**	**x**	**x**	
Bit 6	Open Request	**x**	**x**	**x**	**x**
Bit 7	Spare				
Bit 8	Close Request	**x**	**x**	**x**	**x**
Bit 9	Spare				
Bit 10	Spare				
Bit 11	Spare				
Bit 12	Spare				
Bit 13	Spare				
Bit 14	Spare				
Bit 15	Spare				

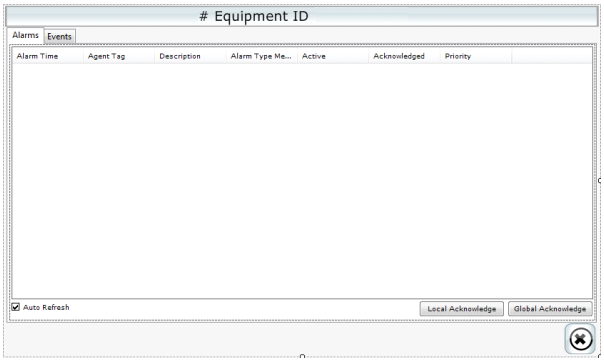
SCADA Status Word (Adroit Marshal Agent)		Alarmed	Advanced	Standard	Basic
Bit 0	Process Interlock Ok		x	x	
Bit 1	Valve Healthy		x	x	x
Bit 2	Closed		x	x	x
Bit 3	Opening		x	x	x
Bit 4	Opened		x	x	x
Bit 5	Closing		x	x	x
Bit 6	Fault		x	x	x
Bit 7	Safety Fault	x	x		
Bit 8	Spare				
Bit 9	Spare				
Bit 10	Spare				
Bit 11	Spare				
Bit 12	Open FB		x	x	x
Bit 13	Closed FB		x	x	x
Bit 14	Fault Open	x	x	x	x
Bit 15	Fault Close	x	x	x	x

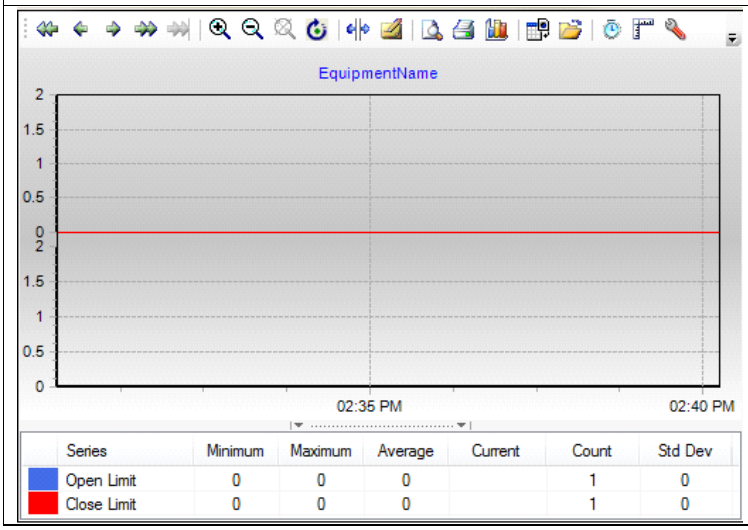
Resources	Advanced	Standard	Basic
Digital Inputs	5	2	2
Digital Outputs	1	1	1
Analog Inputs	0	0	0
Analog Outputs	0	0	0
PLC Memory Steps	264	227	158
System Words Used	6	4	2
System Bits Used	80	75	74
SCADA SCAN Points	10	8	4

Template: Advanced Single Actuating Valve PLC Function Block


Template Graphic: Advanced Home Screen	Control	Description
	Auto	Auto control by PLC
	Manual	Manual control by operator, desk and field mode
	Desk	Manual control from the SCADA faceplate
	Field	Manual control from the field Open/Close station
	Open	Manual open the Valve
	Close	Manual close the Valve
	Reset	Reset the Valve after a fault has been repaired
	Healthy	Healthy to Open
	Open Limit	Valve opened limit input
	Close Limit	Valve closed limit input
	Process Interlock	Valve process ok to open interlock ready
	Safety Fault	Valve safety off fault
	Open Fault	Valve failed to open fault
	Close Fault	Valve failed to close fault

Template Graphic: Advanced Setup Screen	Control	Description
	Simulate	Enable simulation of Valve, disables the physical outputs
	Feedback Time	Time for simulation to simulate open/close feedback signals
	Maintenance	Enable maintenance mode (Disables all interlocks)
	Number of operations	Total number of valve open operations
	Reset	Reset the total number of valve open operations
	Open Signal Delay (SP)	Delay the PLC to accept the valve is open
	Max Opening (SP)	Time for the valve to fail to open
	Last Opened (PV)	Last time the valve taken to open
	Close Signal Delay (SP)	Delay the PLC to accept the valve is close
	Max Closing (SP)	Time for the valve to fail to close
	Last Closed (PV)	Last time the valve taken to close

Template Graphic: Advanced Alarms & Events Screen	Control	Descriptions
	Alarms	Display all the alarms filtered for the current Digital Output
	Events	Display all the events filtered for the current Digital Output.
	Local Acknowledge	Acknowledge all the alarms on locally on the current machine
	Global Acknowledge	Acknowledge all the alarms on globally on all the machines.

Template Graphic: Advanced Trend Screen	Control	Description
	Equipment Name	Display the current valve name of the trend.
	Open limit	Display the status of the open limit of the valve
	Close Limit	Display the status of the close limit of the valve

14.1.11 Valve (Double Actuating) MAPS Template (Electrical)

The Double Actuating Valve MAPS template is designed to control a valve that has two solenoids and two limit switches.

This MAPS template is available in three models – advanced, standard and basic, which provide respectively lower levels of control over the valve.

This describes the Advanced Double Actuating Valve MAPS Template and also defines the level of functionality provided by the standard and basic models. So that you can decide which model best suits your needs. You should consider the following factors in your choice:

- the importance of the valve being controlled and
- the budget of the customer

Since the more complex the model, the greater the required PLC memory usage; number of PLC I/O and SCADA size (scan points) - see the **Resources** table below.

Advanced Double Actuating Valve Functional Philosophy

The valve open output is enabled once all interlocks are ready and an open request is received.

Field Interlocks

- Safety Interlock Feedback

PLC Interlocks

- Process Interlock Ready
- There are no interlock faults latched

Interlock fault recovery process: once a field interlock is activated the face plate will display a red indication, if the interlock is recovered and still latched the faceplate will show a green indication and the reset button on the faceplate will flash, pressing on the reset button will unlatch the interlock and display a grey indication and allow the valve to become ready for operation.

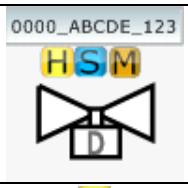
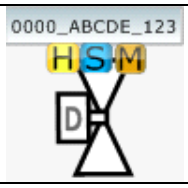
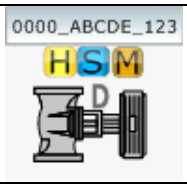
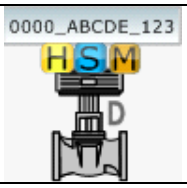
Maintenance mode: disables the Process Interlocks, but respects all the other interlocks. This is used to test a valve while the process is closed.

Simulation mode: disables the physical outputs of the valve and simulate an input limit feedback after the elapsed setpoint time from the faceplate. The Process Interlocks are respected. Simulation mode is used to test the process logic without opening the physical valve itself. It is very useful in commissioning and maintenance.

Open and Close requests: these are initiated by selecting one of the following modes from the valve faceplate:

- **Auto mode**: the auto control program initiates an Open and Close.
- **Manual mode & Desk mode**: the operator initiates an Open and Close from the faceplate.
- **Manual mode & Field mode**: the operator initiates an Open and Close from the Open and Close push buttons in the field.

Typical Faceplate Graphics for the Advanced Double Actuating Valve MAPS Template

Valve ISO DOWN	Valve ISO RIGHT	Valve LEFT	Valve TOP
			

H	Manual Mode
M	Maintenance Mode
S	Simulation Mode
0000_ABCDE_123	Valve Control / Tag Name

Graphics legend:		
Line colour	**Fill colour**	**Valve status**
Black	Grey	Closed
Grey	White	Closing
Green	White	Opening
Black	Green	Opened
Black	Yellow/Red	Fault active

Signal Description		**Agent Type**	**Advanced**	**Standard**	**Basic**
SCADA Control Words:					
SSCL 0	Control Word	**Marshal**	**x**	**x**	**x**
SSCL 1	Fail to Open Setpoint	**Analog**	**x**	**x**	**x**
SSCL 2	Fail to Close Setpoint	**Analog**	**x**	**x**	**x**
SSCL 3	Simulate Setpoint	**Analog**	**x**	**x**	
SSCL 4	Opened Delay Setpoint	**Analog**	**x**		
SSCL 5	Closed Delay Setpoint	**Analog**	**x**		

Signal Description		**Agent Type**	**Advanced**	**Standard**	**Basic**
SCADA Status Words:					
SSSL 0	Status Word	**Marshal**	**x**	**x**	**x**
SSSL 1	Last Opened Time Process Value	**Analog**	**x**	**x**	
SSSL 2	Last Closed Time Process Value	**Analog**	**x**	**x**	
SSSL 3	Number of Operations	**Analog**	**x**	**x**	

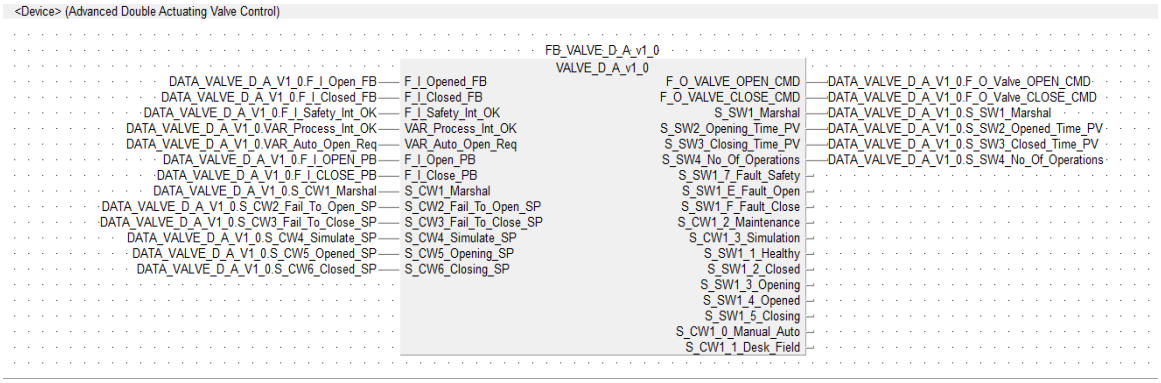
Digital Inputs:		**Advanced**	**Standard**	**Basic**
DI 0	Open Limit Feedback	**x**	**x**	**x**
DI 1	Closed Limit Feedback	**x**	**x**	**x**
DI 2	Safety Interlock Ok	**x**		
DI 3	Open Push Button	**x**		
DI 4	Close Push Button	**x**		
Digital Outputs:				
DO 0	Valve Open Solenoid Command	**x**	**x**	**x**
DO 1	Valve Close Solenoid Command	**x**	**x**	**x**

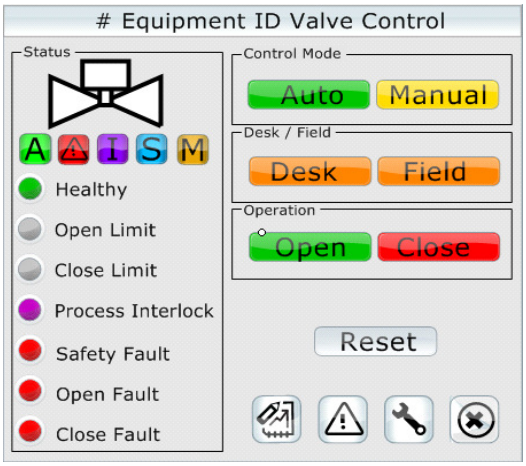
SCADA Control Word (Adroit Marshal Agent)		Event Logged	Advanced	Standard	Basic
Bit 0	Auto Manual	x	x	x	x
Bit 1	Field Desk	x	x	x	x
Bit 2	Maintenance	x	x	x	x
Bit 3	Simulation	x	x	x	
Bit 4	Reset Fault	x	x	x	x
Bit 5	Reset Number of Operations	x	x	x	
Bit 6	Open Request	x	x	x	x
Bit 7	Spare				
Bit 8	Close Request	x	x	x	x
Bit 9	Spare				
Bit 10	Spare				
Bit 11	Spare				
Bit 12	Spare				
Bit 13	Spare				
Bit 14	Spare				
Bit 15	Spare				

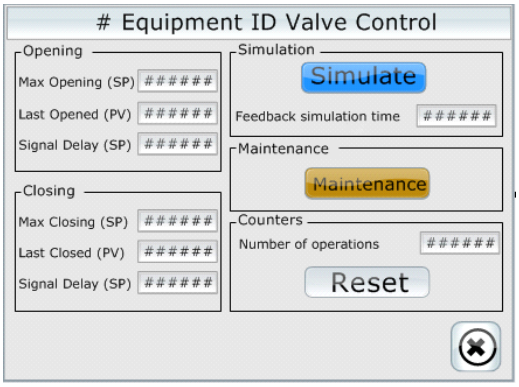
SCADA Status Word (Adroit Marshal Agent)		Alarmed	Advanced	Standard	Basic
Bit 0	Process Interlock Ok		x	x	
Bit 1	Valve Healthy		x	x	x
Bit 2	Closed		x	x	x
Bit 3	Opening		x	x	x
Bit 4	Opened		x	x	x
Bit 5	Closing		x	x	x
Bit 6	Fault		x	x	x
Bit 7	Safety Fault	x	x		
Bit 8	Spare				
Bit 9	Spare				
Bit 10	Spare				
Bit 11	Spare				
Bit 12	Open FB		x	x	x
Bit 13	Closed FB		x	x	x
Bit 14	Fault Open	x	x	x	x
Bit 15	Fault Close	x	x	x	x

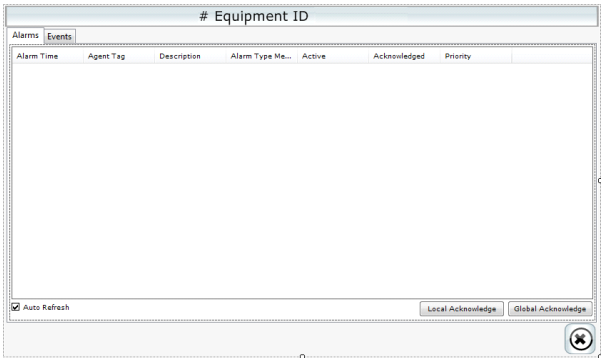
Resources	Advanced	Standard	Basic
Digital Inputs	5	2	2
Digital Outputs	2	2	2
Analog Inputs	0	0	0
Analog Outputs	0	0	0
PLC Memory Steps	264	227	158
System Words Used	6	4	2
System Bits Used	80	75	74
SCADA SCAN Points	10	8	4

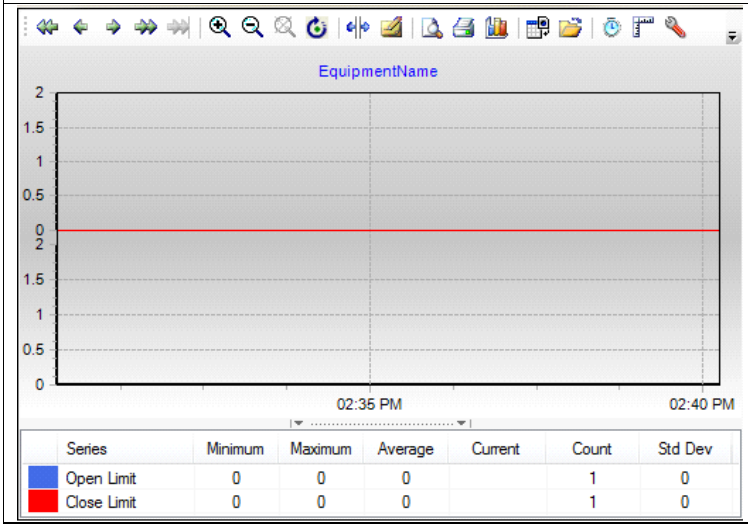
Template: Advanced Double Actuating Valve PLC Function Block



Template Graphic: Advanced Home Screen	Control	Description
	Auto	Auto control by PLC
	Manual	Manual control by operator, desk and field mode
	Desk	Manual control from the SCADA faceplate
	Field	Manual control from the field Open/Close station
	Open	Manual open the Valve
	Close	Manual close the Valve
	Reset	Reset the Valve after a fault has been repaired
	Healthy	Healthy to Open
	Open Limit	Valve opened limit input
	Close Limit	Valve closed limit input
	Process Interlock	Valve process ok to open interlock ready
	Safety Fault	Valve safety off fault
	Open Fault	Valve failed to open fault
	Close Fault	Valve failed to close fault

Template Graphic: Advanced Setup Screen	Control	Description
	Simulate	Enable simulation of Valve, disables the physical outputs
	Feedback Time	Time for simulation to simulate open/close feedback signals
	Maintenance	Enable maintenance mode (Disables all interlocks)
	Number of Operations	Total number of valve open operations
	Reset	Reset the total number of valve open operations
	Open Signal Delay (SP)	Delay the PLC to accept the valve is open
	Max Opening (SP)	Time for the valve to fail to open
	Last Opened (PV)	Last time the valve taken to open
	Close Signal Delay (SP)	Delay the PLC to accept the valve is close
	Max Closing (SP)	Time for the valve to fail to close
	Last Closed (PV)	Last time the valve taken to close

Template Graphic: Advanced Alarms & Events Screen	Control	Descriptions
	Alarms	Display all the alarms filtered for the current Digital Output
	Events	Display all the events filtered for the current Digital Output.
	Local Acknowledge	Acknowledge all the alarms on locally on the current machine
	Global Acknowledge	Acknowledge all the alarms on globally on all the machines.

Template Graphic: Advanced Trend Screen	Control	Description
	Equipment Name	Display the current valve name of the trend.
	Open limit	Display the status of the open limit of the valve
	Close Limit	Display the status of the close limit of the valve

14.2 Instrumentation Equipment

14.2.1 Analog Input MAPS Template (Instrumentation)

The Analog Input MAPS template is designed to control an analog that is connected to an analog control unit.

This MAPS template is available in three models – advanced, standard and basic, which provide respectively lower levels of control over the analog input.

This describes the Advanced Analog Input MAPS Template and also defines the level of functionality provided by the standard and basic models. So that you can decide which model best suits your needs. You should consider the following factors in your choice:

- the importance of the analog being controlled and
- the budget of the customer

Since the more complex the model, the greater the required PLC memory usage; number of PLC I/O and SCADA size (scan points) - see the **Resources** table below.

NOTE: The version 2 (v2) Analog Input MAPS template, communicates Floating point values instead of Integer values to the driver.

Advanced Analog Input Functional Philosophy

The analog input is scaled and alarmed according to the setpoints from the Setup faceplate.

Field inputs

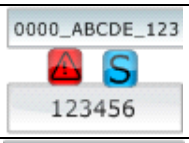
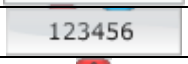
- Analog Input

PLC Setpoints

- High-high Alarm
- High Alarm
- Low Alarm
- Low-low Alarm

Simulation mode: overrides input to the Analog Input and simulates an analog in the PLC program that is controlled from the faceplate. This is used to test the process logic without receiving the physical input itself, which is very useful in testing, commissioning and maintenance.

Typical Faceplate Graphics for the Advanced Analog Input MAPS Template

Analog Input	
	
	Tag name
	Analog indication value
	Fault active
	Simulation mode

Signal Description		Agent Type	Advanced	Standard	Basic
SCADA Control Words:					
SSCL 0	Control Word	**Marshal**	**x**	**x**	**x**
SSCL 1	High-high Alarm	**Analog**	**x**	**x**	
SSCL 2	High Alarm	**Analog**	**x**	**x**	
SSCL 3	Low Alarm	**Analog**	**x**	**x**	
SSCL 4	Low-low Alarm	**Analog**	**x**	**x**	
SSCL 5	Scale Min In Setpoint (Raw Min)	**Analog**	**x**		
SSCL 6	Scale Max In Setpoint (Raw Max)	**Analog**	**x**		
SSCL 7	Scale Min Out Setpoint (Eng. Min)	**Analog**	**x**		
SSCL 8	Scale Max Out Setpoint (Eng. Max)	**Analog**	**x**		
SSCL 9	Simulation Value	**Analog**	**x**	**x**	**x**
SSCL 10	Alarm Hysteresis	**Analog**	**x**	**x**	

Signal Description		Agent Type	Advanced	Standard	Basic
SCADA Status Words:					
SSSL 0	Status Word	**Marshal**	**x**	**x**	**x**
SSSL 1	Analog Input Process Value (Scaled)	**Analog**	**x**	**x**	**x**
SSSL 2	Analog Input RAW Value	**Analog**	**x**		

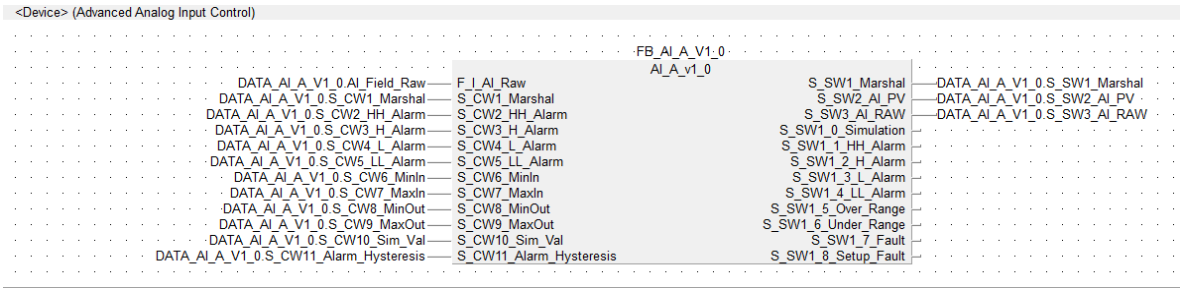
Analog Input:		Advanced	Standard	Basic
AI 0	Analog Input for Analog Input	**x**	**x**	**x**

SCADA Control Word (Adroit Marshal Agent)		Event Logged	Advanced	Standard	Basic
Bit 0	Simulation	x	x	x	x
Bit 1	High-high AI Alarm Enabled	x	x	x	
Bit 2	High AI Alarm Enabled	x	x	x	
Bit 3	Low AI Alarm Enabled	x	x	x	
Bit 4	Low-Low AI Alarm Enabled	x	x	x	
Bit 5	Reset Fault		x	x	x
Bit 6	Spare				
Bit 7	Spare				
Bit 8	Spare				
Bit 9	Spare				
Bit 10	Spare				
Bit 11	Spare				
Bit 12	Spare				
Bit 13	Spare				
Bit 14	Spare				
Bit 15	Spare				

SCADA Status Word (Adroit Marshal Agent)		Alarmed	Advanced	Standard	Basic
Bit 0	Simulation On		x	x	x
Bit 1	High-high Alarm Active	x	x	x	
Bit 2	High Alarm Active	x	x	x	
Bit 3	Low Alarm Active	x	x	x	
Bit 4	Low-low Alarm Active	x	x	x	
Bit 5	Warning Active	x	x	x	
Bit 6	Alarm Active	x	x	x	
Bit 7	Alarm Fault Latch		x	x	x
Bit 8	Alarm Setup Fault		x	x	
Bit 9	Spare				
Bit 10	Spare				
Bit 11	Spare				
Bit 12	Spare				
Bit 13	Spare				
Bit 14	Spare				
Bit 15	Spare				

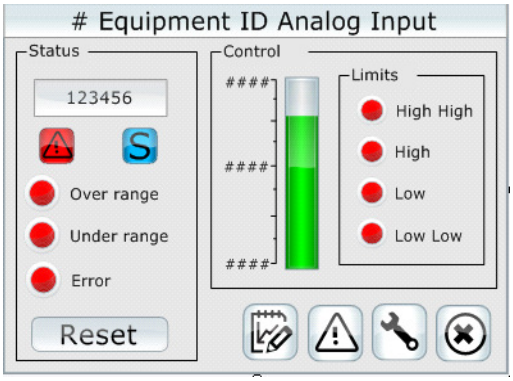
Resources	Advanced	Standard	Basic
Digital Inputs	0	0	0
Digital Outputs	0	0	0
Analog Inputs	1	1	1
Analog Outputs	0	0	0
PLC Memory Steps	359	173	86
System Words Used	40	3	2
System Bits Used	72	61	56

Template: Advanced Analog Input PLC Function Block

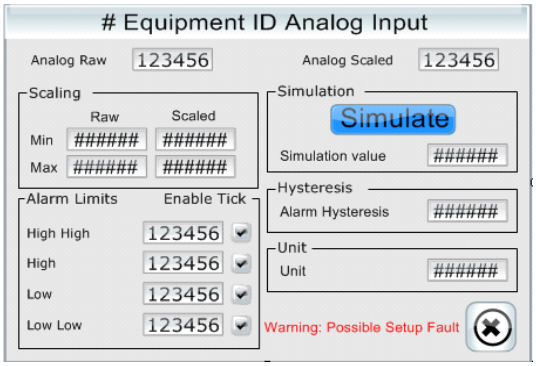


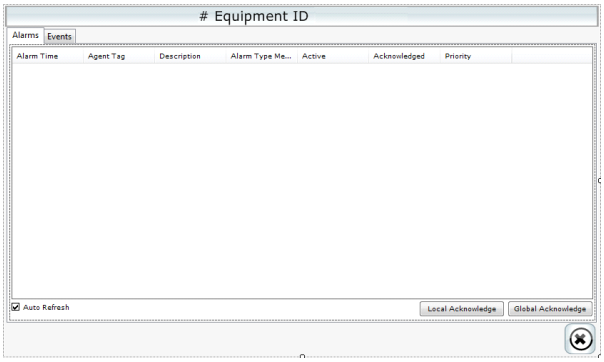
SCADA SCAN Points	14	9	4

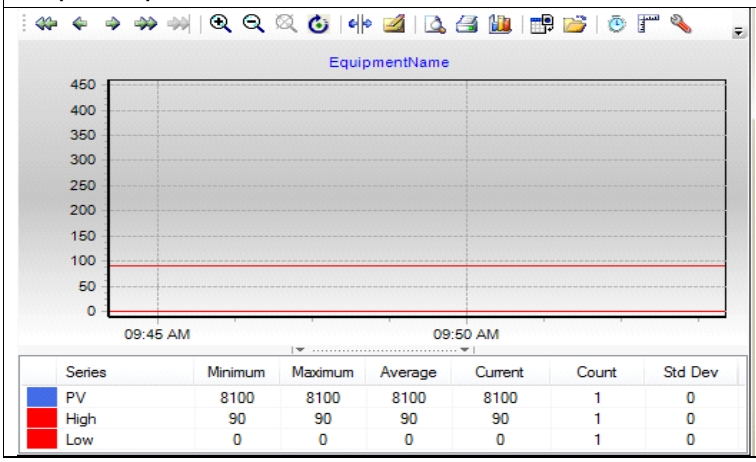
Template Graphic: Advanced Home Screen Screen



Control	Descriptions
# Equipment ID	Analog Input controlled name
High High	High-high alarm indication
High	High alarm indication
Low	Low alarm indication
Low Low	Low-low alarm indication
Over range	Analog over range alarm
Under range	Analog under range alarm
Error	Alarm fault latch
Reset	Reset the analog Input after a fault has been
123456	Analog scaled value indication
S	Simulation indication
	Alarm fault latch

Template Graphic: Advanced Setup Screen	Control	Descriptions
	Simulate	Enable simulation of analog Input, disables the physical output
	Simulation Value	Simulation value of analog Input
	Analog Raw	Raw value from field level
	Analog Scaled	Scaled value from field level
	Min, Max Raw	Raw level input values for scaling
	Min, Max Scaled	Engineering level values for scaling
	High High	High-high alarm setup value and enabling
	High	High warning setup value and enabling
	Low	Low warning setup value and enabling
	Low Low	Low-low alarm setup value and enabling
	Alarm Hysteresis	High and low warning auto reset hysteresis value. This is a value at which the warnings will reset should the process value decrease – in the case of the high level or increase - in the case of a low level
	Unit	Unit displayed for the scaled analog

Template Graphic: Advanced Alarms & Events Screen	Control	Descriptions
	Alarms	Display all the alarms filtered for the current Digital Output
	Events	Display all the events filtered for the current Digital Output.
	Local Acknowledge	Acknowledge all the alarms on locally on the current machine
	Global Acknowledge	Acknowledge all the alarms on globally on all the machines.

Template Graphic: Advanced Trend Screen	Control	Descriptions
	Equipment Name	Display the name of the current analog Input of the trend
	PV	Display the level of the current level
	High	High Setpoint for analog scaled value
	Low	Low Setpoint for analog scaled value

14.2.2 Analog Output MAPS Template (Instrumentation)

The Analog Output MAPS template controls an analog that is connected to an analog control unit.

This MAPS template is available in three models – advanced, standard and basic, which provide respectively lower levels of control over the analog output.

This describes the Advanced Analog Output MAPS Template and also defines the level of functionality provided by the standard and basic models. So that you can decide which model best suits your needs. You should consider the following factors in your choice:

- the importance of the analog being controlled and
- the budget of the customer

Since the more complex the model, the greater the required PLC memory usage; number of PLC I/O and SCADA size (scan points) - see the **Resources** table below.

NOTE: The version 2 (v2) Analog Output MAPS template, communicates Floating point values instead of Integer values to the driver.

Advanced Analog Output Functional Philosophy

The analog output is scaled and alarmed according to the setpoints from the Setup faceplate.

Field inputs

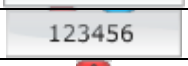
- Analog Output

PLC Setpoints

- High-high Alarm
- High Alarm
- Low Alarm
- Low-low Alarm

Simulation mode: disables the physical analog output and simulates an analog in the PLC program that is controlled from the faceplate. This is used to test the process logic without receiving the physical output itself, which is very useful in testing, commissioning and maintenance.

Typical Faceplate Graphics for the Advanced Analog Output MAPS Template

Analog Output	
	
	Control/Tag name
	Analog Indication Value
	Fault active
	Manual mode

Signal Description		Agent Type	Advanced	Standard	Basic
SCADA Control Words:					
SSCL 0	Control Word	**Marshal**	**x**	**x**	**x**
SSCL 1	High-high Alarm	**Analog**	**x**	**x**	
SSCL 2	High Alarm	**Analog**	**x**	**x**	
SSCL 3	Low Alarm	**Analog**	**x**	**x**	
SSCL 4	Low-low Alarm	**Analog**	**x**	**x**	
SSCL 5	Scale Min In Setpoint (Raw Min)	**Analog**	**x**		
SSCL 6	Scale Max In Setpoint (Raw Max)	**Analog**	**x**		
SSCL 7	Scale Min Out Setpoint (Eng. Min)	**Analog**	**x**		
SSCL 8	Scale Max Out Setpoint (Eng. Max)	**Analog**	**x**		
SSCL 9	Simulation Value	**Analog**	**x**	**x**	**x**
SSCL 10	Alarm Hysteresis	**Analog**	**x**	**x**	

Signal Description		Agent Type	Advanced	Standard	Basic
SCADA Status Words:					
SSSL 0	Status Word	**Marshal**	**x**	**x**	**x**
SSSL 1	Analog Output Process Value (Scaled)	**Analog**	**x**	**x**	**x**
SSSL 2	Analog Output RAW Value	**Analog**	**x**		

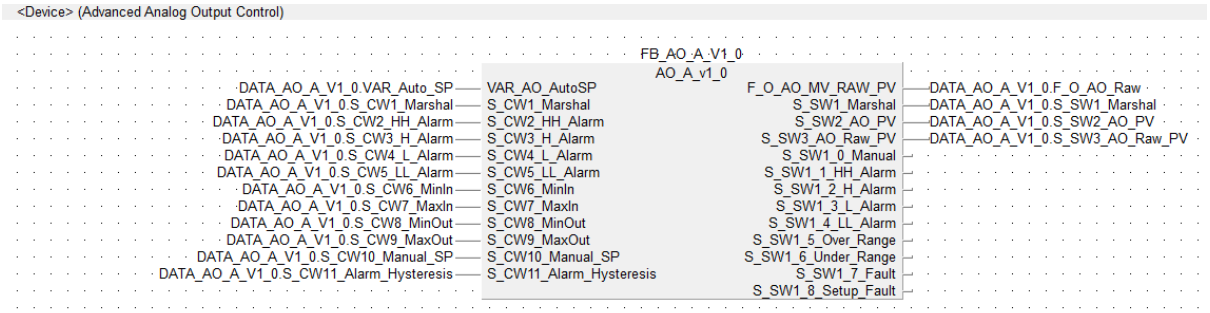
Analog Output:		Advanced	Standard	Basic
AO 0	Analog Output for Analog Output	**x**	**x**	**x**

SCADA Control Word (Adroit Marshal Agent)		Event Logged	Advanced	Standard	Basic
Bit 0	Simulation	x	x	x	x
Bit 1	High-high AO Alarm Enabled	x	x	x	
Bit 2	High AO Alarm Enabled	x	x	x	
Bit 3	Low AO Alarm Enabled	x	x	x	
Bit 4	Low Low AO Alarm Enabled	x	x	x	
Bit 5	Reset Fault		x	x	x
Bit 6	Spare				
Bit 7	Spare				
Bit 8	Spare				
Bit 9	Spare				
Bit 10	Spare				
Bit 11	Spare				
Bit 12	Spare				
Bit 13	Spare				
Bit 14	Spare				
Bit 15	Spare				

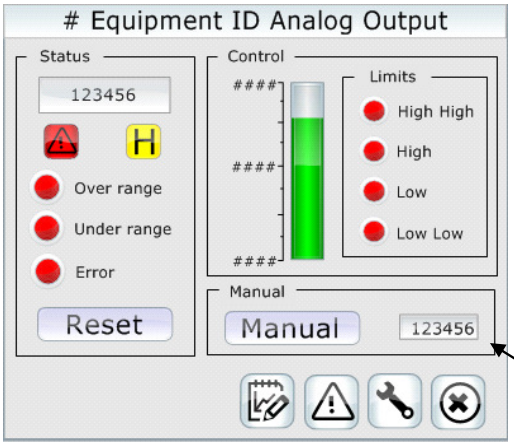
SCADA Status Word (Adroit Marshal Agent)		Alarmed	Advanced	Standard	Basic
Bit 0	Simulation On		x	x	x
Bit 1	High-high Alarm Active	x	x	x	
Bit 2	High Alarm Active	x	x	x	
Bit 3	Low Alarm Active	x	x	x	
Bit 4	Low-low Alarm Active	x	x	x	
Bit 5	Warning Active	x	x	x	
Bit 6	Alarm Active	x	x	x	
Bit 7	Alarm Fault Latch		x	x	x
Bit 8	Alarm Setup Fault		x	x	
Bit 9	Spare				
Bit 10	Spare				
Bit 11	Spare				
Bit 12	Spare				
Bit 13	Spare				
Bit 14	Spare				
Bit 15	Spare				

Resources	Advanced	Standard	Basic
Digital Inputs	0	0	0
Digital Outputs	0	0	0
Analog Inputs	0	0	0
Analog Outputs	1	1	1
PLC Memory Steps	355	271	82
System Words Used	40	40	2
System Bits Used	71	63	51
SCADA SCAN Points	14	9	4

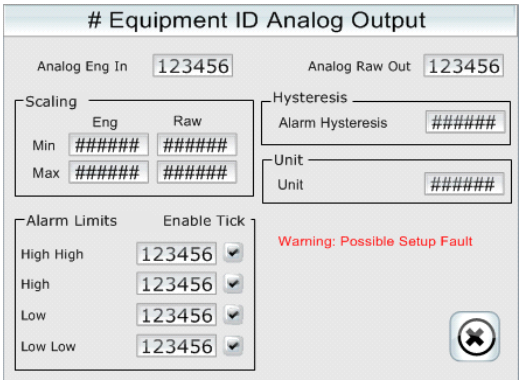
Template: Advanced Analog Output PLC Function Block

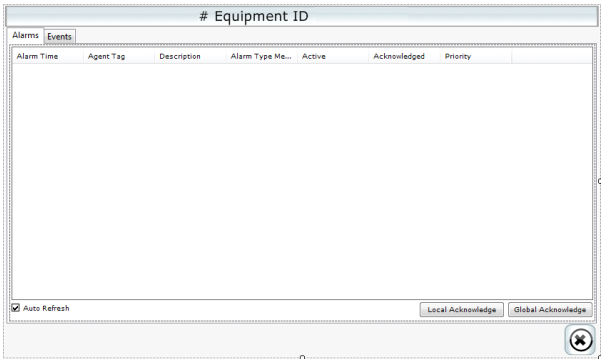


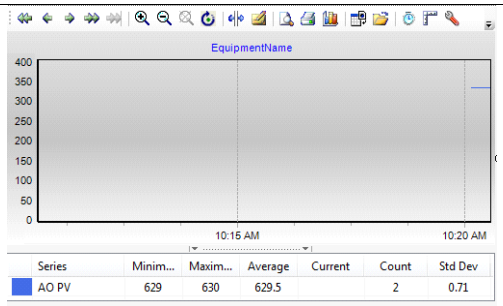
Template Graphic: Advanced Home Screen Screen



Control	Descriptions
# Equipment ID	Analog Output controlled name
High High	High-high alarm indication
High	High alarm indication
Low	Low alarm indication
Low Low	Low-low alarm indication
Over range	Analog over range alarm
Under range	Analog under range alarm
Error	Alarm fault latch
Reset	Reset the analog Output after a fault has been
123456	Analog scaled value indication
Manual	Manual mode enable button
123456	Manual mode analog output default value
H	Manual indication
	Alarm fault latch

Template Graphic: Advanced Setup Screen	Control	Descriptions
	Analog Raw Out	Raw value scaled from input value for analog output
	Analog Eng In	Value from PLC for analog
	Min, Max Raw	Raw output values for scaling
	Min, Max Scaled	Engineering input values for scaling
	High High	High-high alarm setup value and enabling
	High	High warning setup value and enabling
	Low	Low warning setup value and enabling
	Low Low	Low-low alarm setup value and enabling
	Alarm Hysteresis	High and low warning auto reset hysteresis value. This is a value at which the warnings will reset should the process value decrease – in the case of the high level or increase - in the case of a low level
	Unit	Unit displayed for the scaled analog

Template Graphic: Advanced Alarms & Events Screen	Control	Descriptions
	Alarms	Display all the alarms filtered for the current Digital Output
	Events	Display all the events filtered for the current Digital Output.
	Local Acknowledge	Acknowledge all the alarms on locally on the current machine
	Global Acknowledge	Acknowledge all the alarms on globally on all the machines.

Template Graphic: Advanced Trend Screen	Control	Descriptions
	Equipment Name	Display the name of the current analog Output of the trend
	AO PV	Display the level of the current level

14.2.3 Digital Input MAPS Template (Instrumentation)

The Digital Input MAPS template is designed to control a digital input.

This MAPS template is available in three models – advanced, standard and basic, which provide respectively lower levels of control over the digital input.

This describes the Advanced Digital Input MAPS Template and also defines the level of functionality provided by the standard and basic models. So that you can decide which model best suits your needs. You should consider the following factors in your choice:

- the importance of the digital being controlled and
- the budget of the customer

Since the more complex the model, the greater the required PLC memory usage; number of PLC I/O and SCADA size (scan points) - see the **Resources** table below.

Advanced Digital Input Functional Philosophy

The digital input is sent to the control program once the field input is triggered or an operator enables it from the faceplate.

Field Inputs

- Digital Input

Simulation mode: overrides the input to the digital input block and simulates a digital input in the PLC program that is controlled from the faceplate. This is used to test the process logic without receiving the physical input itself, which is very useful in testing, commissioning and maintenance.

Typical Faceplate Graphics for the Advanced Digital Input MAPS Template

Digital Input	
	
	Control/ Tag name
	Simulation mode indication
	Digital input status indication

Signal Description		Agent Type	Advanced	Standard	Basic
SCADA Control Words:					
SSCL 0	Control Word	**Marshal**	**x**	**x**	**x**
SSCL 1	Delay On Setpoint Time	**Analog**	**x**	**x**	
SSCL 2	Delay Off Setpoint Time	**Analog**	**x**		

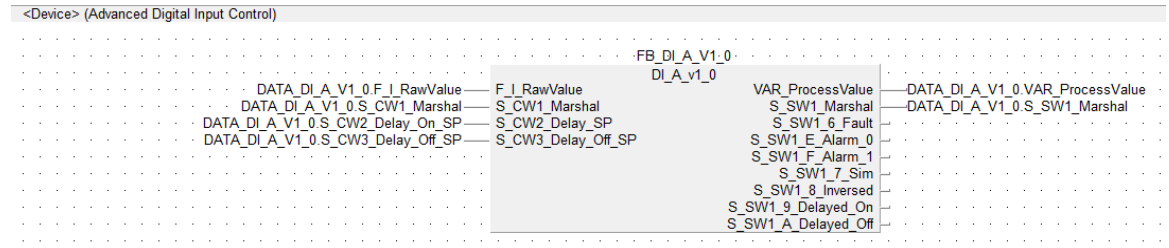
Signal Description		Agent Type	Advanced	Standard	Basic
SCADA Status Words:					
SSSL 0	Status Word	**Marshal**	**x**	**x**	**x**

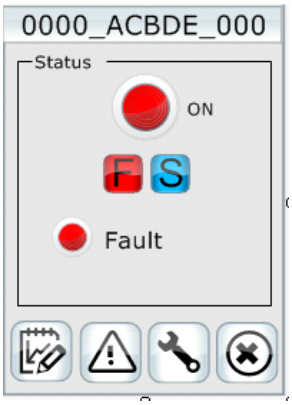
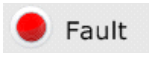
Digital Input:		Advanced	Standard	Basic
DI 0	Digital Input	**x**	**x**	**x**

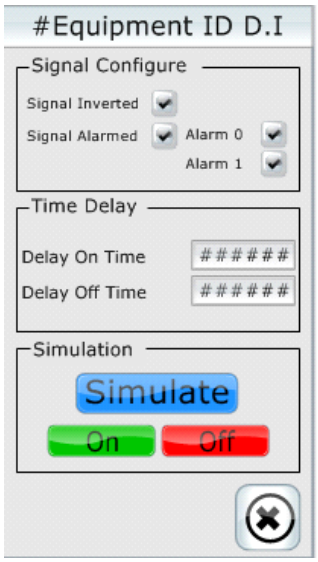
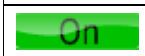
SCADA Control Word (Adroit Marshal Agent)		Event Logged	Advanced	Standard	Basic
Bit 0	Input inverted	**x**	**x**	**x**	**x**
Bit 1	Spare				
Bit 2	Spare				
Bit 3	Simulation Enabled	**x**	**x**	**x**	**x**
Bit 4	Simulation Value	**x**	**x**	**x**	**x**
Bit 5	Alarm Enabled	**x**	**x**	**x**	**x**
Bit 6	Alarm on bit off	**x**	**x**	**x**	**x**
Bit 7	Alarm on bit on	**x**	**x**	**x**	**x**
Bit 8	Spare				
Bit 9	Spare				
Bit 10	Spare				
Bit 11	Spare				
Bit 12	Spare				
Bit 13	Spare				
Bit 14	Spare				
Bit 15	Spare				

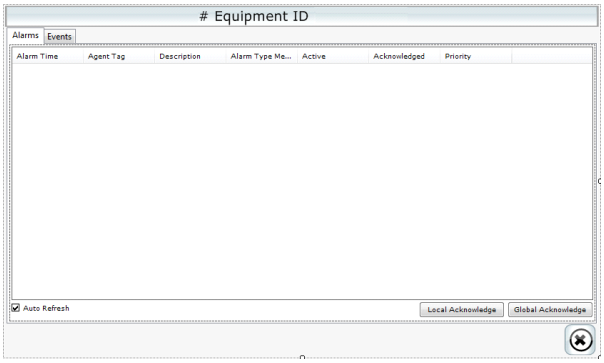
SCADA Status Word (Adroit Marshal Agent)		Alarmed	Advanced	Standard	Basic
Bit 0	Spare				
Bit 1	Spare				
Bit 2	Input Status Process Value		x	x	x
Bit 3	Spare				
Bit 4	Spare				
Bit 5	Spare				
Bit 6	Fault Active	x	x	x	x
Bit 7	Simulation Enabled		x	x	x
Bit 8	Input Inverted		x	x	x
Bit 9	Delayed On		x	x	
Bit 10	Delayed Off		x		
Bit 11	Spare				
Bit 12	Spare				
Bit 13	Spare				
Bit 14	Alarm bit 0	x	x	x	x
Bit 15	Alarm bit 1	x	x	x	x

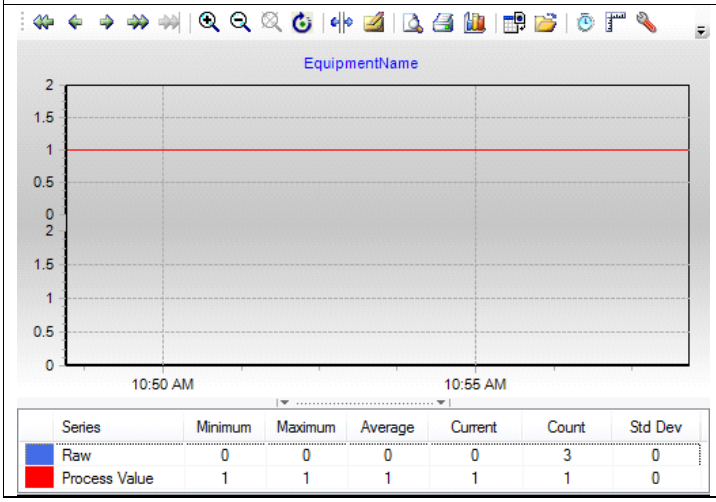
Resources	Advanced	Standard	Basic
Digital Inputs	1	1	1
Digital Outputs	0	0	0
Analog Inputs	0	0	0
Analog Outputs	0	0	0
PLC Memory Steps	159	122	108
System Words Used	4	1	0
System Bits Used	64	59	58
SCADA SCAN Points	4	3	2

Template: Advanced Digital Input PLC Function Block


Template Graphic: Advanced Home Screen	Control	Descriptions
		Digital Input controlled name
		High-high alarm indication
		High alarm indication
		Low alarm indication
		Low-low alarm indication

Template Graphic: Advanced Setup Screen	Control	Descriptions
		Digital Input Name
		Enable the digital input signal to be inverted
		Enable the digital input signal to be alarmed
		Alarm on bit off
		Alarm on bit on
Delay On Time		Delay the digital input to switch on
Delay Off Time		Delay the digital input to switch off
		Simulate the digital input
		Simulate the digital input on
		Simulate the digital input off

Template Graphic: Advanced Alarms & Events Screen	Control	Descriptions
	Alarms	Display all the alarms filtered for the current Digital Output
	Events	Display all the events filtered for the current Digital Output.
	Local Acknowledge	Acknowledge all the alarms on locally on the current machine
	Global Acknowledge	Acknowledge all the alarms on globally on all the machines.

Template Graphic: Advanced Trend Screen	Control	Descriptions
	Equipment Name	Display the name of the current digital Input of the trend
	Raw	Display the raw digital input value
	Process Value	Display the processed digital input value

14.2.4 Digital Output MAPS Template (Instrumentation)

The Digital Output MAPS template is designed to control a digital output.

This MAPS template is available in three models – advanced, standard and basic, which provide respectively lower levels of control over the digital output.

This describes the Advanced Digital Output MAPS Template and also defines the level of functionality provided by the standard and basic models. So that you can decide which model best suits your needs. You should consider the following factors in your choice:

- the importance of the digital being controlled and
- the budget of the customer

Since the more complex the model, the greater the required PLC memory usage; number of PLC I/O and SCADA size (scan points) - see the **Resources** table below.

Advanced Digital Output Functional Philosophy

The digital output is enabled once an enable request is received from the PLC auto control program or an operator enables it from the faceplate.

Field Outputs

- Digital Output

Simulation mode: disables the physical digital output and simulates the digital output in the PLC program. This is used to test the process logic without enabling the physical output itself, which is very useful in testing, commissioning and maintenance.

Typical Faceplate Graphics for the Advanced Digital Output MAPS Template

Digital Output	
	
	Control / Tag name
	Manual mode indication
	Simulation mode indication
	Digital output status indication

Signal Description		Agent Type	Advanced	Standard	Basic
SCADA Control Words:					
SSCL 0	Control Word	**Marshal**	**x**	**x**	**x**
SSCL 1	Delay On Setpoint Time	**Analog**	**x**	**x**	
SSCL 2	Delay Off Setpoint Time	**Analog**	**x**		

Signal Description		Agent Type	Advanced	Standard	Basic
SCADA Status Words:					
SSSL 0	Status Word	**Marshal**	**x**	**x**	**x**

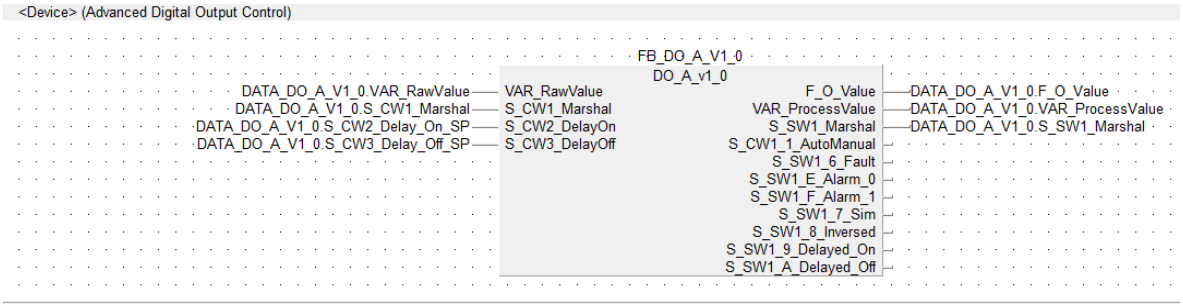
Digital Output:		Advanced	Standard	Basic
DO 0	Digital Output	**x**	**x**	**x**

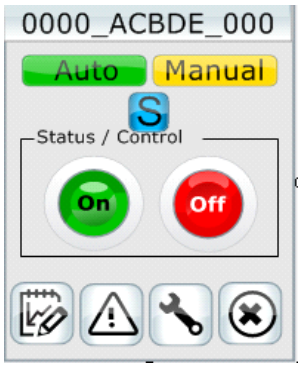
SCADA Control Word (Adroit Marshal Agent)		Event Logged	Advanced	Standard	Basic
Bit 0	Output inverted	x	x	x	x
Bit 1	Auto/Manual Mode	x	x	x	x
Bit 2	Spare				
Bit 3	Simulation Enabled	x	x	x	x
Bit 4	Simulation Value	x	x	x	x
Bit 5	Alarm Enabled	x	x	x	x
Bit 6	Alarm on bit off	x	x	x	x
Bit 7	Alarm on bit on	x	x	x	x
Bit 8	Spare				
Bit 9	Spare				
Bit 10	Spare				
Bit 11	Spare				
Bit 12	Spare				
Bit 13	Spare				
Bit 14	Spare				
Bit 15	Spare				

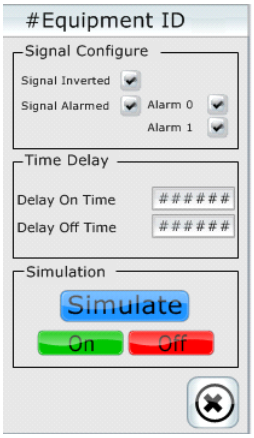
SCADA Status Word (Adroit Marshal Agent)		Alarmed	Advanced	Standard	Basic
Bit 0	Spare				
Bit 1	Physical Field Output Value		x	x	x
Bit 2	Output Status Process Value		x	x	x
Bit 3	Spare				
Bit 4	Spare				
Bit 5	Spare				
Bit 6	Fault Active	x	x	x	x
Bit 7	Simulation Enabled		x	x	x
Bit 8	Output Inverted		x	x	x
Bit 9	Delayed On		x	x	
Bit 10	Delayed Off		x		
Bit 11	Spare				
Bit 12	Spare				
Bit 13	Spare				
Bit 14	Alarm bit 0	x	x	x	x
Bit 15	Alarm bit 1	x	x	x	x

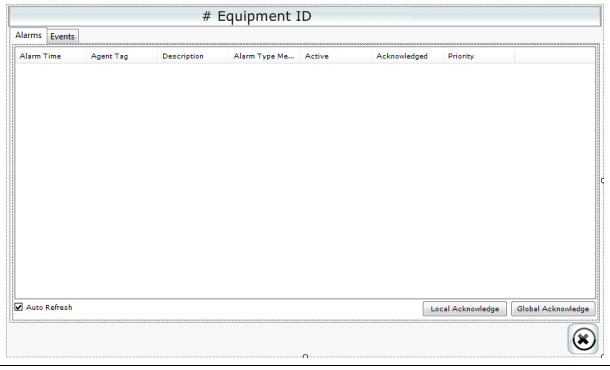
Resources	Advanced	Standard	Basic
Digital Inputs	0	0	0
Digital Outputs	1	1	1
Analog Inputs	0	0	0
Analog Outputs	0	0	0
PLC Memory Steps	141	121	105
System Words Used	2	1	0
System Bits Used	64	61	59
SCADA SCAN Points	4	3	2

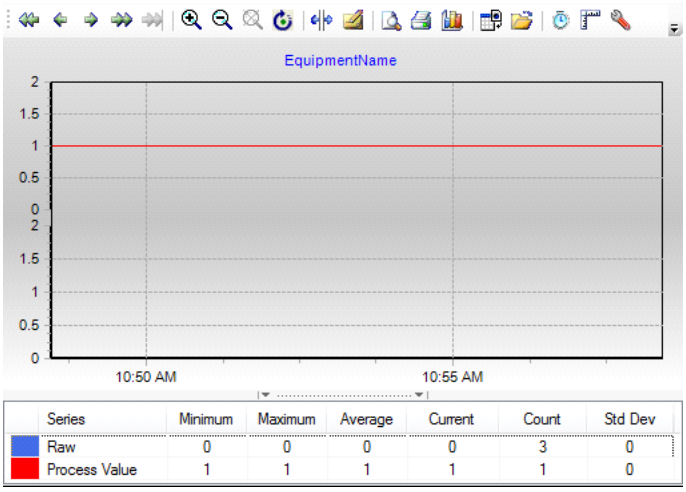
Template: Advanced Digital Output PLC Function Block



Template Graphic: Advanced Home Screen	Control	Descriptions
	0000_ACBDE_000	Digital Output controlled name
	Auto	Auto indication
	Manual	Manual indication
	S	Simulation indication
	On	Switch digital output on and display on indication
	Off	Switch digital output off and display off indication

Template Graphic: Advanced Setup Screen	Control	Descriptions
	#Equipment ID	Digital output name
	Signal Inverted	Enable the digital output signal to be inverted
	Signal Alarmed	Enable the digital output signal to be alarmed
	Alarm 0	Alarm on bit off
	Alarm 1	Alarm on bit on
	Delay On Time	Delay the digital output to switch on
	Delay Off Time	Delay the digital output to switch off
	Simulate	Simulate the digital output
	On	Simulate the digital output on
	Off	Simulate the digital output off

Template Graphic: Advanced Alarms & Events Screen	Control	Descriptions
	Alarms	Display all the alarms filtered for the current Digital Output
	Events	Display all the events filtered for the current Digital Output.
	Local Acknowledge	Acknowledge all the alarms on locally on the current machine
	Global Acknowledge	Acknowledge all the alarms on globally on all the machines.

Template Graphic: Advanced Trend Screen	Control	Descriptions
 Series / Minimum / Maximum / Average / Current / Count / Std Dev Raw 0 0 0 0 3 0 Process Value 1 1 1 1 1 0	Equipment Name	Display the name of the current digital Output of the trend
	Raw	Display the raw digital output value
	Process Value	Display the processed digital output value

14.2.5 Flow Meter Start MAPS Template (Instrumentation)

The Flow Meter MAPS template is designed to capture the data from a Flow meter and calculate the different flow rates.
All MAPS templates provide the following:

- an associated PLC function block
- a set of SCADA tags (Adroit agents) linked to the provided signals
- an associated SCADA graphic with inbuilt faceplates

This document describes the Advanced and Basic models of the Flow Meter MAPS Templates. For details of their required PLC memory usage; number of PLC I/O and SCADA size (scan points) - see the **Resources** table below.

Flow Meter Functional Philosophy

The Flow meter block receives an Analogue signal which represents the Instantaneous flow in meters per second. This signal is then scaled to give the instantaneous flow Meters Cube per minute, total flow Meters Cube, total flow hours, daily total flow Meters Cube, and daily total flow Hours etc.

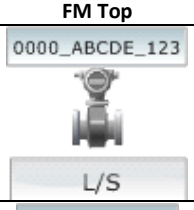
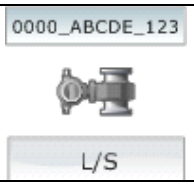
Field Interlocks

- None

Interlock fault recovery process – None

The start of flow calculation is enabled by setting the minimum flow rate on the **Setup** screen of the flow meter.

Typical Faceplate Graphics for the Flow Meter MAPS Template

FM Top	FM Bottom	FM Left	FM Right	
				
	Flow Meter Control Name			
	Instantaneous flow in meters per second			

Graphics legend:

Line colour	Fill colour	DOL status
Black	Grey	No Flow
Black	Green	Flowing
Black	Yellow/Red	Fault Active

Signal Description		Agent Type	Advanced	Basic
SCADA Control Words:				
SSCL 0	Control Word	**Marshal**	**x**	**x**
SSCL 1	Minimum IN (Raw Minimum)	**Analog**	**x**	**x**
SSCL 2	Maximum IN (Raw Maximum)	**Analog**	**x**	**x**
SSCL 3	Minimum OUT (Eng Minimum)	**Analog**	**x**	**x**
SSCL 4	Maximum OUT (Eng Maximum)	**Analog**	**x**	**x**
SSCL 5	Minimum Flow	**Analog**	**x**	**x**
SSCL 6	High Flow Set point	**Analog**	**x**	
SSCL 7	Low Flow Set point	**Analog**	**x**	

Signal Description		Agent Type	Advanced	Basic
SCADA Status Words:		**Analog**	**x**	**x**
SSSL 0	Instantaneous Flow Litres/Second	**Analog**	**x**	**x**
SSSL 1	Instantaneous Flow Metres Cubed/Hour	**Analog**	**x**	**x**
SSSL 2	Totalised Flow Value Metres Cubed (M3)	**Analog**	**x**	**x**
SSSL 3	Totalised Flow Hours	**Analog**	**x**	**x**
SSSL 4	Current Daily Total Flow (M3)	**Analog**	**x**	**x**
SSSL 5	Current Daily Flow Hours (Hrs.)	**Analog**	**x**	**x**
SSSL 6	Resettable Flow Value (M3)	**Analog**	**x**	**x**
SSSL 7	Resettable Flow Hours Value (Hrs.)	**Analog**	**x**	**x**
SSSL 8	Kilowatt-hour vs. Flow	**Analog**	**x**	**x**
SSSL 9	Status Word	**Marshal**	**x**	**x**

Digital Inputs:		Advanced	Basic
DI 0	Flow Meter Pulse	**x**	**x**
Digital Outputs:			
Analog Inputs:			
AI 0	Flow Meter Flow Rate	**x**	**x**

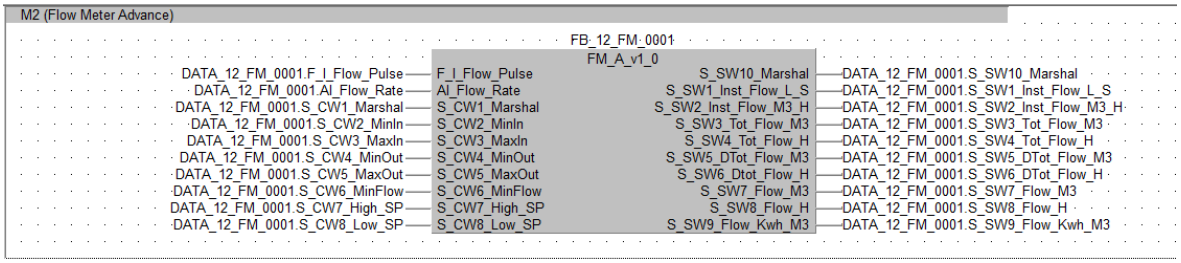
SCADA Control Word (Adroit Marshal Agent)		Event Logged	Advanced	Basic
Bit 0	Reset Flow	**x**	**x**	**x**
Bit 1	Reset Hours	**x**	**x**	**x**
Bit 2	Reset Daily	**x**	**x**	**x**
Bit 3	Spare			
Bit 4	Spare			
Bit 5	Spare			
Bit 6	Spare			
Bit 7	Spare			
Bit 8	Spare			
Bit 9	Spare			
Bit 10	Spare			
Bit 11	Spare			
Bit 12	Spare			

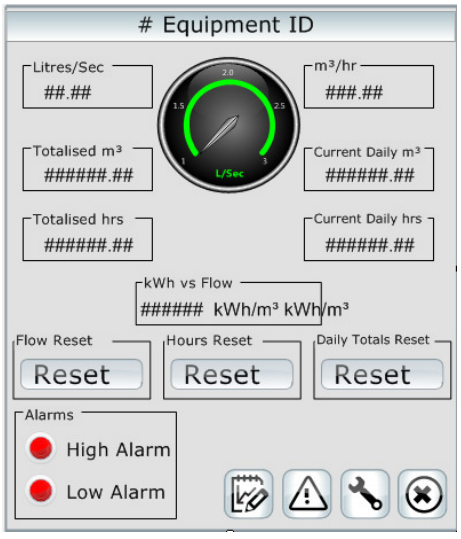
Bit 13	Spare			
Bit 14	Spare			
Bit 15	Spare			

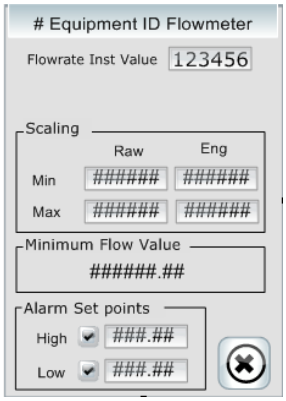
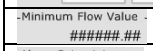
SCADA Status Word (Adroit Marshal Agent)		Alarmed	Advanced	Basic
Bit 0	Daily Reset		x	x
Bit 1	Flowing		x	x
Bit 2	Spare		x	x
Bit 3	High Flow Alarm	x	x	
Bit 4	Low Flow Alarm	x	x	
Bit 5	Spare			
Bit 6	Spare			
Bit 7	Spare			
Bit 8	Spare			
Bit 9	Spare			
Bit 10	Spare			
Bit 11	Spare			
Bit 12	Spare			
Bit 13	Spare			
Bit 14	Spare			
Bit 15	Spare			

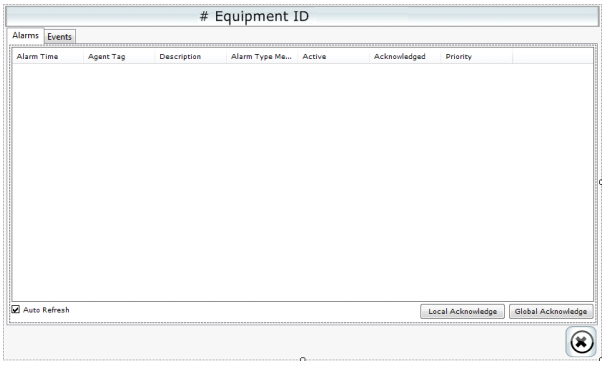
Resources	Advanced	Basic
Digital Inputs	1	1
Digital Outputs	0	0
Analog Inputs	1	1
Analog Outputs	0	0
PLC Memory Steps	441	417
System Words Used	45	45
System Bits Used	71	69
SCADA SCAN Points	18	18

Template: Advanced Flow Meter PLC Function Block



Template Graphic: Advanced Home Screen	Control	Descriptions
	Reset	Reset Flow, Hours, Daily Totals

Template Graphic: Advanced Setup Screen	Control	Descriptions
		Flow Rate Scaling
		Minimum flow rate before calculations starts
		Alarm Set points and enables.

Template Graphic: Advanced Alarms & Events Screen	Control	Descriptions
	Alarms	Display all the alarms filtered for the current Digital Output
	Events	Display all the events filtered for the current Digital Output.
	Local Acknowledge	Acknowledge all the alarms on locally on the current machine
	Global Acknowledge	Acknowledge all the alarms on globally on all the machines.

14.2.6 Group Start MAPS Template (Instrumentation)

The Group Start MAPS template is designed to control a process.

This MAPS template is available in two models – advanced and standard, which provide respectively lower levels of control over the group.

This describes the Advanced Group Start MAPS Template and also defines the level of functionality provided by the standard model. So that you can decide which model best suits your needs. You should consider the following factors in your choice:

- the importance of the group being controlled and
- the budget of the customer

Since the more complex the model, the greater the required PLC memory usage; number of PLC I/O and SCADA size (scan points) - see the **Resources** table below.

Advanced Group Start Functional Philosophy

The group start outputs are enabled by the operator, once requests are received.

The Start, Stop and Reset requests are set by the operator from the faceplate.

The faceplate displays the current status (Starting, Stopping, Stopped or Running) of the group.

Typical Faceplate Graphics for the Advanced Group Start MAPS Template

Group Start Advanced	Group Start Standard	
		
	Start Request	
	Stop Request	
	Reset Request	
	Group Name	

Graphics legend:		
Start Button	**Stop Button**	**Group status**
Light Green	Dark Red	Stopped
Light Green	Medium Red	Stopping
Medium Green	Light Red	Starting
Dark Green	Light Red	Running

Signal Description		**Agent Type**	**Advanced**	**Standard**	**Basic**
SCADA Control Words:					
SSCL 0	Control Word	**Marshal**	**x**	**x**	

Signal Description		**Agent Type**	**Advanced**	**Standard**	**Basic**
SCADA Status Words:					
SSSL 0	Status Word	**Marshal**	**x**	**x**	

SCADA Control Word (Adroit Marshal Agent)		**Event Logged**	**Advanced**	**Standard**	**Basic**
Bit 0	Start Pulse		**x**	**x**	
Bit 1	Stop Pulse		**x**	**x**	
Bit 2	Reset Pulse		**x**		
Bit 3	Spare				
Bit 4	Spare				
Bit 5	Spare				
Bit 6	Spare				
Bit 7	Spare				
Bit 8	Spare				
Bit 9	Spare				
Bit 10	Spare				
Bit 11	Spare				
Bit 12	Spare				
Bit 13	Spare				
Bit 14	Spare				
Bit 15	Spare				

SCADA Status Word (Adroit Marshal Agent)		Alarmed	Advanced	Standard	Basic
Bit 0	Stopped		x	x	
Bit 1	Stopping		x	x	
Bit 2	Starting		x	x	
Bit 3	Running		x	x	
Bit 4	Spare				
Bit 5	Spare				
Bit 6	Spare				
Bit 7	Spare				
Bit 8	Spare				
Bit 9	Spare				
Bit 10	Spare				
Bit 11	Spare				
Bit 12	Spare				
Bit 13	Spare				
Bit 14	Spare				
Bit 15	Spare				

Resources	Advanced	Standard	Basic
Digital Inputs	0	0	
Digital Outputs	0	0	
Analog Inputs	0	0	
Analog Outputs	0	0	
PLC Memory Steps	92	89	
System Words Used	0	0	
System Bits Used	60	59	
SCADA SCAN Points	2	2	

14.2.7 PID MAPS Template (Instrumentation)

The PID MAPS template is designed to control a device that is connected to an analog output.

This MAPS template is available in two models – advanced and standard, which provide respectively lower levels of control over the PID.

This describes the Advanced PID MAPS Template and also defines the level of functionality provided by the standard model. So that you can decide which model best suits your needs. You should consider the following factors in your choice:

- the importance of the device being controlled and
- the budget of the customer

Since the more complex the model, the greater the required PLC memory usage; number of PLC I/O and SCADA size (scan points) - see the **Resources** table below.

Advanced PID Functional Philosophy

The PID Modified Value output is enabled once all setpoints are set and the start request is received.

During PID control, the value measured by the sensor (process value) is compared with the preset value (set value).

The output value (manipulated value) is then adjusted in order to eliminate the difference between the process value and the set value.

The MV (manipulated value) is calculated by combining the proportionate operation (P), the integrating operation (I), and the differentiating operation (D) so that the PV is brought to the same value as the SV quickly and precisely.

The MV is made large when the difference between the PV and the SV is large so as to bring the PV close to the SV quickly. As the difference between the PV and the SV gets smaller, a smaller MV is used to bring the PV to the same value as the SV gradually and accurately.

PID Setpoints

- PID Setpoint
- P Setpoint
- I Setpoint
- D Setpoint
- Sample Setpoint
- In Filter Setpoint
- MV Lim Hi
- MV Lim Lo
- Raw Min
- Raw Max
- Eng. Min
- Eng. Max

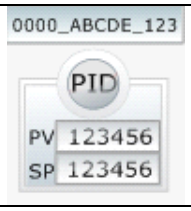
PLC Interlocks

- Start Interlock Ready

Start requests: these are initiated by selecting one of the following modes from the PID faceplate:

- **Auto mode**: the auto control program set the MV value.
- **Manual mode**: the operator can set a fixed MV value from the faceplate.

Typical Faceplate Graphics for the Advanced PID MAPS Template

PID	
	
PV	PID Process Value
SP	PID Setpoint Value (Preset value)
0000_ABCDE_123	PID Control/ Tag Name

Signal Description		Agent Type	Advanced	Standard	Basic
SCADA Control Words:					
SSCL 0	Control Word	**Marshal**	**x**	**x**	
SSCL 1	PID Setpoint	**Analog**	**x**	**x**	
SSCL 2	P Setpoint	**Analog**	**x**	**x**	
SSCL 3	I Setpoint	**Analog**	**x**	**x**	
SSCL 4	D Setpoint	**Analog**	**x**	**x**	
SSCL 5	Sample Setpoint	**Analog**	**x**	**x**	
SSCL 6	In Filter Setpoint	**Analog**	**x**	**x**	
SSCL 7	MV Lim Hi	**Analog**	**x**	**x**	
SSCL 8	MV Lim Lo	**Analog**	**x**	**x**	
SSCL 9	MV Manual Setpoint	**Analog**	**x**	**x**	
SSCL 10	Raw Min	**Analog**	**x**		
SSCL 11	Raw Max	**Analog**	**x**		
SSCL 12	Eng Min	**Analog**	**x**		
SSCL 13	Eng Max	**Analog**	**x**		

Signal Description		Agent Type	Advanced	Standard	Basic
SCADA Status Words:					
SSSL 0	Status Word	**Marshal**	**x**	**x**	
SSSL 1	PID Process Value	**Analog**	**x**	**x**	
SSSL 2	PID Manipulated Value	**Analog**	**x**	**x**	
Analog Input:			**Advanced**	**Standard**	**Basic**
AI 0	PID Process Value		**x**	**x**	
Analog Output:					
AO 0	PID Modified Value		**x**	**x**	

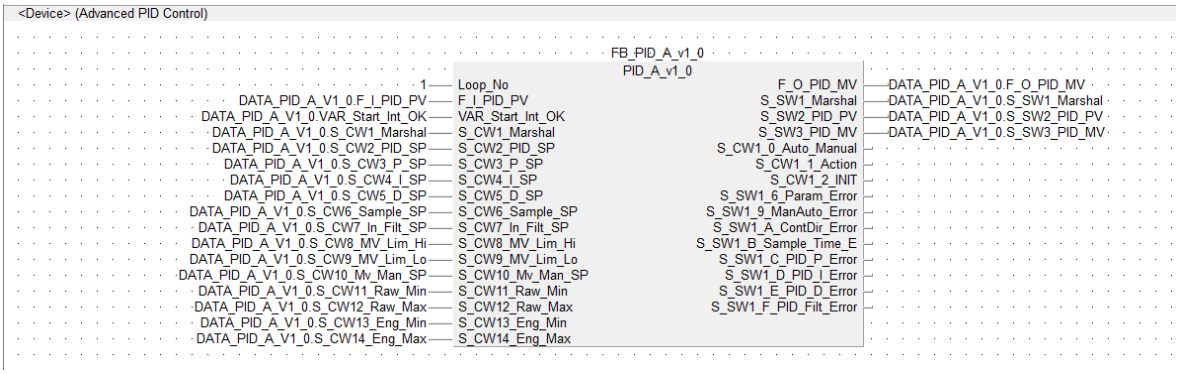
SCADA Control Word (Adroit Marshal Agent)		Event Logged	Advanced	Standard	Basic
Bit 0	Auto Manual	**x**	**x**	**x**	
Bit 1	Control Direction	**x**	**x**	**x**	
Bit 2	Initiate	**x**	**x**	**x**	
Bit 3	Spare				
Bit 4	Spare				
Bit 5	Spare				

Bit 6	Spare				
Bit 7	Spare				
Bit 8	Spare				
Bit 9	Spare				
Bit 10	Spare				
Bit 11	Spare				
Bit 12	Spare				
Bit 13	Spare				
Bit 14	Spare				
Bit 15	Spare				

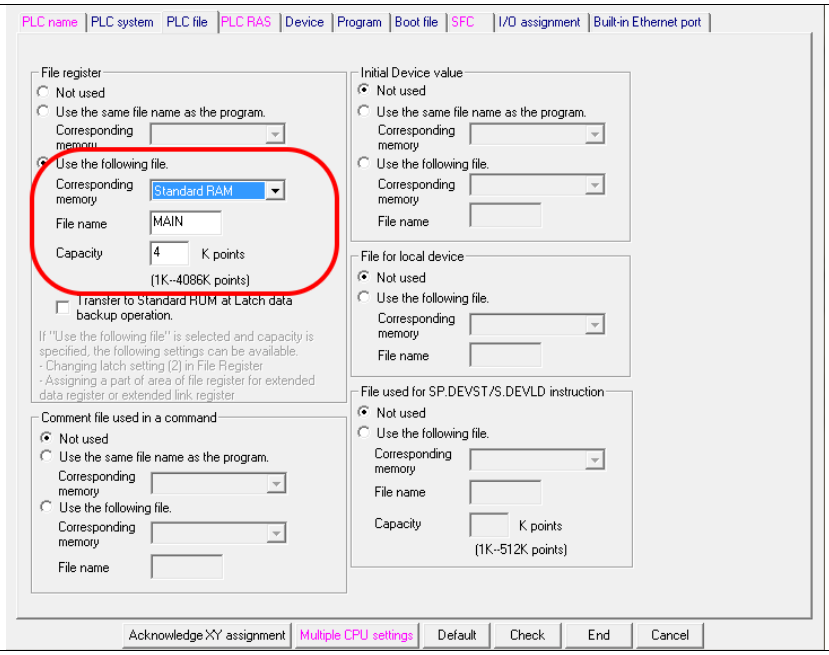
SCADA Status Word (Adroit Marshal Agent)		Alarmed	Advanced	Standard	Basic
Bit 0	Spare				
Bit 1	Spare				
Bit 2	Spare				
Bit 3	Spare				
Bit 4	Spare				
Bit 5	Spare				
Bit 6	Parameter Fault	x	x	x	
Bit 7	Spare				
Bit 8	Spare				
Bit 9	Auto Man Fault	x	x	x	
Bit 10	Control Direction Fault	x	x	x	
Bit 11	Sample Time Fault	x	x	x	
Bit 12	Proportional Band Fault	x	x	x	
Bit 13	Integral Band Fault	x	x	x	
Bit 14	Derivative Band Fault	x	x	x	
Bit 15	Filter Fault	x	x	x	

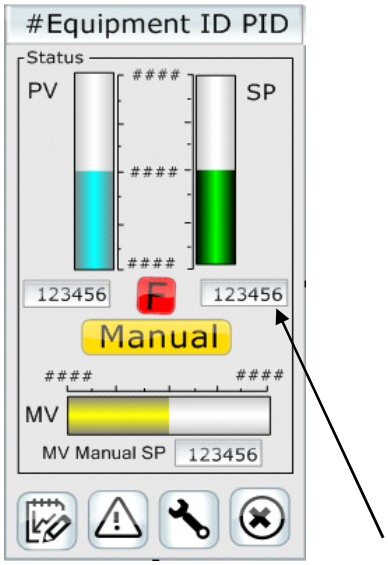
Resources	Advanced	Standard	Basic
Digital Inputs	0	0	
Digital Outputs	0	0	
Analog Inputs	1	1	
Analog Outputs	1	1	
PLC Memory Steps	412	250	
System Words Used	46	11	
System Bits Used	74	68	
SCADA SCAN Points	17	13	

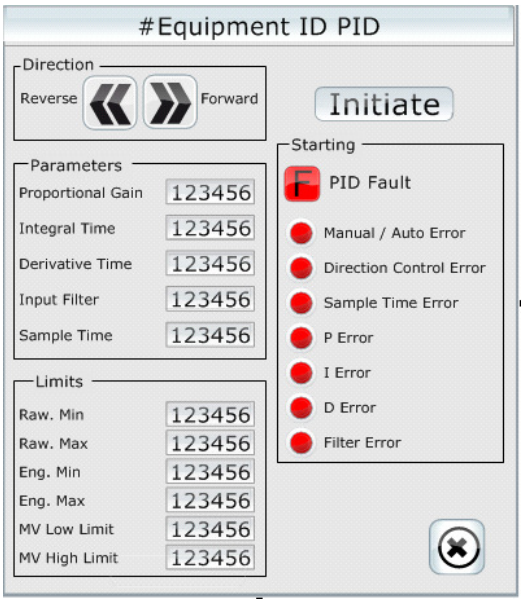
Template: Advanced PID PLC Function Block

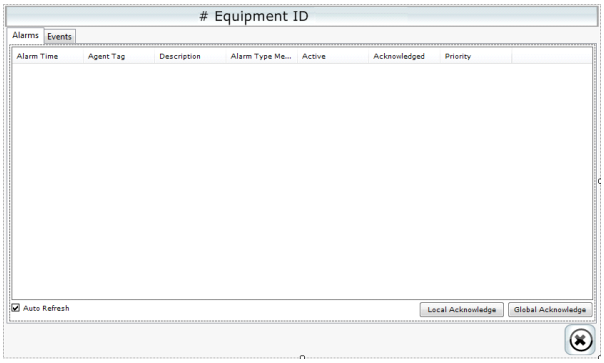


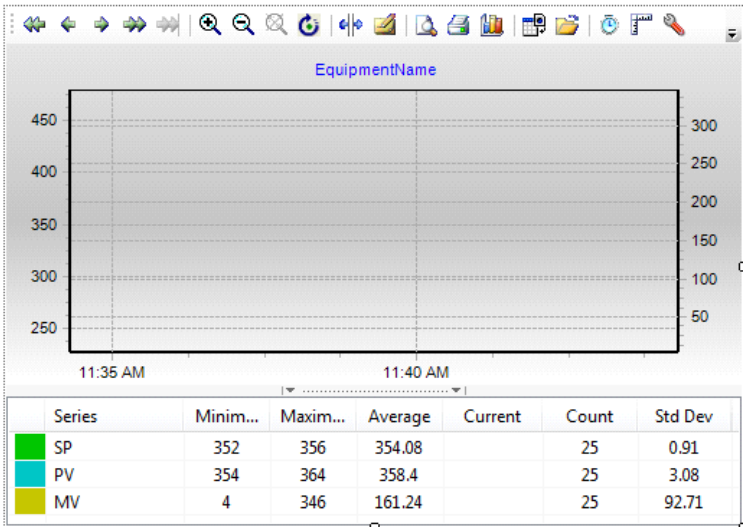
Setup: Advanced PID PLC File Register Setup



Template Graphic: Advanced Home Screen	Control	Descriptions
	#Equipment ID PID	PID Control/ Tag Name
	Manual	Manual control MV value by operator
	MV Manual SP	Manual Setpoint for MV (Manipulated Value)
	F	Manual control from the field start/stop station
	PV	PID Process Value
	SP	PID Setpoint Value
	PID Setpoint	Sets the PID Control Setpoint Value

Template Graphic: Advanced Setup Screen	Control	Descriptions
	Initiate	Initiates the PID once a Setpoint have changed
	Proportional Gain	Proportional Operation (P) Setpoint
	Integral Time	Integral Operation (I) Setpoint
	Derivative Time	Differential Operation (D) Setpoint
	Sample Time	Sampling Cycle (Ts) Setpoint
	Input Filter	Filter Coefficient Setpoint
	MV High Limit	Manipulated Value High Limit (Mv Lim Hi) Setpoint
	MV Low Limit	Manipulated Value Low Limit (Mv Lim Lo) Setpoint
	Raw. Min	Scale Raw Minimum Input
	Raw. Max	Scale Raw Maximum Input
	Eng. Min	Scale Engineering Minimum Output
	Eng. Max	Scale Engineering Maximum Output
	Forward	Forward operation, the MV (manipulated value) increases as the PV (process value) increases beyond the SV (set value).
	Reverse	Reverse operation, the MV (manipulated value) increases as the PV (process value) decreases below the SV (set value).

Template Graphic: Advanced Alarms & Events Screen	Control	Descriptions
	Alarms	Display all the alarms filtered for the current Digital Output
	Events	Display all the events filtered for the current Digital Output.
	Local Acknowledge	Acknowledge all the alarms on locally on the current machine
	Global Acknowledge	Acknowledge all the alarms on globally on all the machines.

Template Graphic: Advanced Trend Screen	Control	Descriptions
	Equipment Name	Name of controlled PID
	SP	Trend of PID Setpoint Value (Preset value)
	PV	Trend of PID Process Value (Input value)
	MV	Trend of PID Manipulated Value (Output value)

14.2.8 Power Meter (Janitza) MAPS Template (Instrumentation)

The Janitza Power Meter MAPS template is designed to capture the data from a Janitza Power Meter and display the different values.
All MAPS templates provide the following:

- an associated PLC function block
- a set of SCADA tags (Adroit agents) linked to the provided signals
- an associated SCADA graphic with inbuilt faceplates

This document describes the Basic Janitza Power Meter MAPS Template. For details of its required PLC memory usage; number of PLC I/O and SCADA size (scan points) - see the **Resources** table below.

Janitza Power Meter Functional Philosophy

The power meter is connected via Modbus the block receives power signal which represents the various power measurements. These signals are then scaled according to the Current Transformer ratings from the Power Meter to display the various power measurements.

Field Interlocks

- None

Interlock fault recovery process – None

Typical Faceplate Graphics for the Janitza Power Meter MAPS Template

Janitza Power Meter				
0000_ABCDE_123 L1 ##.## L2 ##.## L3 ##.##				
0000_ABCDE_123	Flow Meter Control Name			
L1 ##.##	L1 Current Display (Amps)			
L2 ##.##	L2 Current Display (Amps)			
L3 ##.##	L3 Current Display (Amps)			

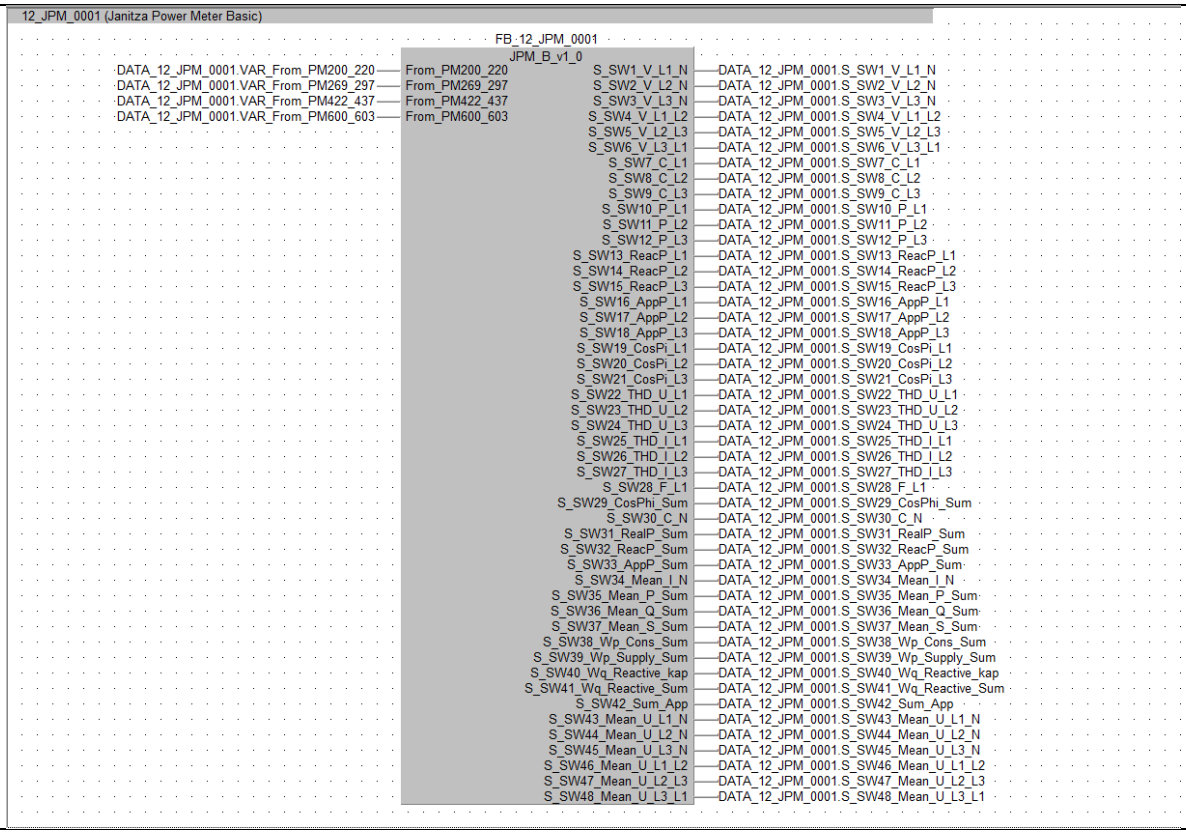
Signal Description	Agent Type	Basic	
SCADA Control Words:			

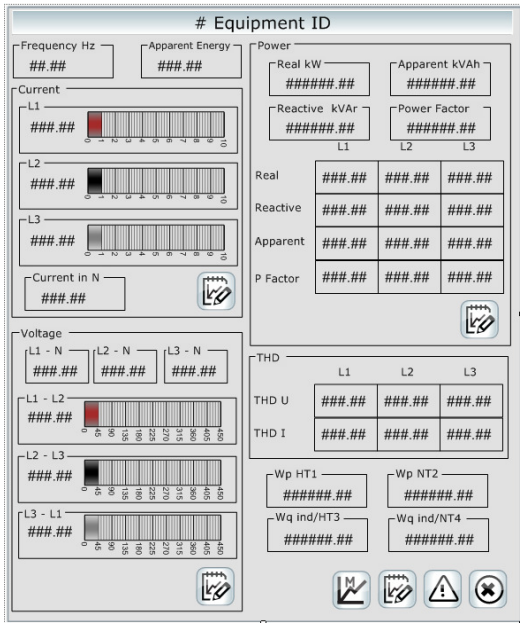
Signal Description		Agent Type	Basic	
SCADA Status Words:				
SSSL 0	Voltage L1 - N	**Analog**	**x**	
SSSL 1	Voltage L2 - N	**Analog**	**x**	
SSSL 2	Voltage L3 - N	**Analog**	**x**	
SSSL 3	Voltage L1 - L2	**Analog**	**x**	
SSSL 4	Voltage L2 - L3	**Analog**	**x**	
SSSL 5	Voltage L2 - L1	**Analog**	**x**	
SSSL 6	Current in L1	**Analog**	**x**	
SSSL 7	Current in L2	**Analog**	**x**	
SSSL 8	Current in L3	**Analog**	**x**	
SSSL 9	Real power L1	**Analog**	**x**	
SSSL 10	Real power L2	**Analog**	**x**	
SSSL 11	Real power L3	**Analog**	**x**	
SSSL 12	Reactive power L1	**Analog**	**x**	
SSSL 13	Reactive power L2	**Analog**	**x**	
SSSL 14	Reactive power L3	**Analog**	**x**	
SSSL 15	Apparent power L1	**Analog**	**x**	
SSSL 16	Apparent power L2	**Analog**	**x**	
SSSL 17	Apparent power L3	**Analog**	**x**	
SSSL 18	Cosinus Phi in L1	**Analog**	**x**	
SSSL 19	Cosinus Phi in L2	**Analog**	**x**	
SSSL 20	Cosinus Phi in L3	**Analog**	**x**	
SSSL 21	THD U L1	**Analog**	**x**	
SSSL 22	THD U L2	**Analog**	**x**	
SSSL 23	THD U L3	**Analog**	**x**	
SSSL 24	THD I L1	**Analog**	**x**	
SSSL 25	THD I L2	**Analog**	**x**	

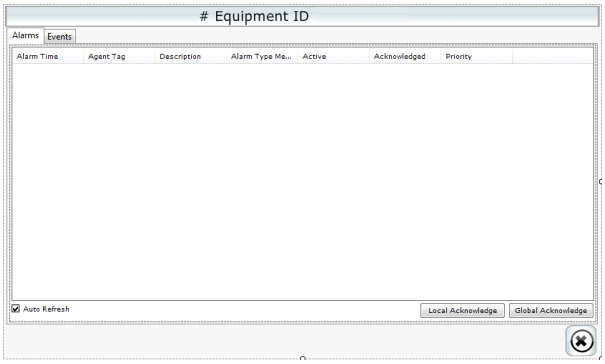
SSSL 26	THD I L3	**Analog**	**x**	
SSSL 27	Frequency L1	**Analog**	**x**	
SSSL 28	Cosinus Phi, Sum	**Analog**	**x**	
SSSL 29	Current in N	**Analog**	**x**	
SSSL 30	Real power, Sum	**Analog**	**x**	
SSSL 31	Reactive power, Sum	**Analog**	**x**	
SSSL 32	Apparent power, Sum	**Analog**	**x**	
SSSL 33	Mean value I in N	**Analog**	**x**	
SSSL 34	Mean value P, Sum	**Analog**	**x**	
SSSL 35	Mean value Q, Sum	**Analog**	**x**	
SSSL 36	Mean value S, Sum	**Analog**	**x**	
SSSL 37	Sum, real energy Wp, Consumption or HT1	**Analog**	**x**	
SSSL 38	Sum, real energy Wp, supply or NT2	**Analog**	**x**	
SSSL 39	Sum, reactive energy Wq, kap. or ind/HT3	**Analog**	**x**	
SSSL 40	Sum, reactive energy Wq, sum or ind/NT4	**Analog**	**x**	
SSSL 41	Sum, apparent energy	**Analog**	**x**	
SSSL 42	Mean values U L1-N	**Analog**	**x**	
SSSL 43	Mean values U L2-N	**Analog**	**x**	
SSSL 44	Mean values U L3-N	**Analog**	**x**	
SSSL 45	Mean values U L1-L2	**Analog**	**x**	
SSSL 46	Mean values U L2-L3	**Analog**	**x**	
SSSL 47	Mean values U L3-L1	**Analog**	**x**	

Resources	Basic	
Digital Inputs	0	
Digital Outputs	0	
Analog Inputs	0	
Analog Outputs	0	
PLC Memory Steps	465	
System Words Used	90	
System Bits Used	2	
SCADA SCAN Points	48	

Template: Advanced Flow Meter PLC Function Block



Template Graphic: Advanced Home Screen	Control	Descriptions
		

Template Graphic: Advanced Alarms & Events Screen	Control	Descriptions
	Alarms	Display all the alarms filtered for the current Digital Output
	Events	Display all the events filtered for the current Digital Output.
	Local Acknowledge	Acknowledge all the alarms on locally on the current machine
	Global Acknowledge	Acknowledge all the alarms on globally on all the machines.

14.2.9 Totalizer MAPS Template (Instrumentation)

The Totalizer MAPS template is designed to control a totalizer that is connected with digital inputs that increments and decrements the totalizer accumulated value.

This describes the Advanced Totalizer MAPS Template. For details of its required PLC memory usage; number of PLC I/O and SCADA size (scan points) - see the **Resources** table below.

Advanced Totalizer Functional Philosophy

The Totalizer is accumulated and alarmed according to the setpoints from the Setup faceplate.

Field Interlocks

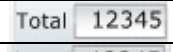
- Increment Totalizer Input
- Decrement Totalizer Input
- Reset Totalizer Input
- Enable Interlock Input

PLC Setpoints

- High-high Alarm
- High Alarm
- Low Alarm
- Low-low Alarm
- Under Range
- Over Range

Simulation mode: overrides input to the Totalizer and simulates an analog in the PLC program that is controlled from the faceplate. This is used to test the process logic without receiving the physical input itself, which is very useful in testing, commissioning and maintenance.

Typical Faceplate Graphics for the Advanced Totalizer MAPS Template

Totalizer	
	
	Tag name
	Current live total
	Last total on reset
	Fault active
	Simulation mode

Signal Description		Agent Type	Advanced	Standard	Basic
SCADA Control Words:					
SSCL 0	Control Word	**Marshal**	**x**		
SSCL 1	Total Min	**Analog**	**x**		
SSCL 2	Total Max	**Analog**	**x**		

SSCL 3	Reset SP	**Analog**	**x**		
SSCL 4	Increment SP	**Analog**	**x**		
SSCL 5	Decrement SP	**Analog**	**x**		
SSCL 6	Low-low Alarm	**Analog**	**x**		
SSCL 7	Low Alarm	**Analog**	**x**		
SSCL 8	High Alarm	**Analog**	**x**		
SSCL 9	High-high Alarm	**Analog**	**x**		

Signal Description		**Agent Type**	**Advanced**	**Standard**	**Basic**
SCADA Status Words:					
SSSL 0	Status Word	**Marshal**	**x**		
SSSL 1	Totalizer Live Value	**Analog**	**x**		
SSSL 2	Totalizer Last Value	**Analog**	**x**		

SCADA Control Word (Adroit Marshal Agent)		**Event Logged**	**Advanced**	**Standard**	**Basic**
Bit 0	High-high AI Alarm Enabled	**x**	**x**		
Bit 1	High AI Alarm Enabled	**x**	**x**		
Bit 2	Low AI Alarm Enabled	**x**	**x**		
Bit 3	Low-Low AI Alarm Enabled	**x**	**x**		
Bit 4	Increase Pulse	**x**	**x**		
Bit 5	Decrease Pulse	**x**	**x**		
Bit 6	Enable Auto Reset	**x**	**x**		
Bit 7	Enable Live Reset	**x**	**x**		
Bit 8	Enable Last Reset	**x**	**x**		
Bit 9	Spare				
Bit 10	Spare				
Bit 11	Spare				
Bit 12	SCADA Simulation	**x**	**x**		
Bit 13	Fault Reset		**x**		
Bit 14	Data Reset	**x**	**x**		
Bit 15	Spare				

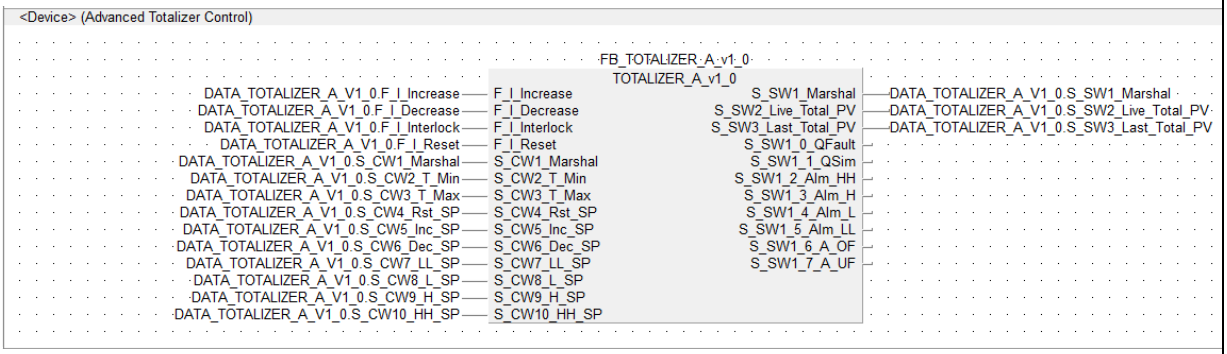
SCADA Status Word (Adroit Marshal Agent)		**Alarmed**	**Advanced**	**Standard**	**Basic**
Bit 0	Fault	**x**	**x**		
Bit 1	Simulation On	**x**	**x**		
Bit 2	High-high Alarm Active	**x**	**x**		
Bit 3	High Alarm Active	**x**	**x**		
Bit 4	Low Alarm Active	**x**	**x**		
Bit 5	Low-low Alarm Active	**x**	**x**		
Bit 6	Over Range Active	**x**	**x**		
Bit 7	Under Range Active	**x**	**x**		
Bit 8	Spare				
Bit 9	Spare				
Bit 10	Spare				

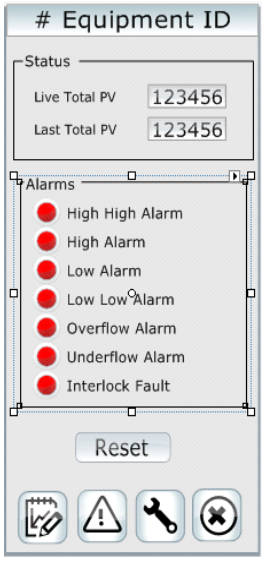
Bit 11	Spare				
Bit 12	Spare				
Bit 13	Spare				
Bit 14	Spare				
Bit 15	Spare				

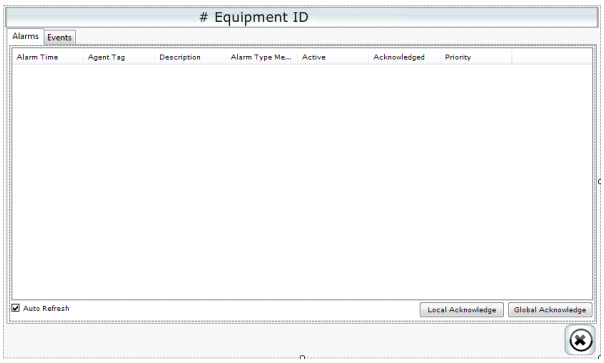
Digital Inputs:		**Advanced**	**Standard**	**Basic**
DI 0	Increase	**x**		
DI 1	Decrease	**x**		
DI 2	Interlock	**x**		
DI 3	Reset Total	**x**		

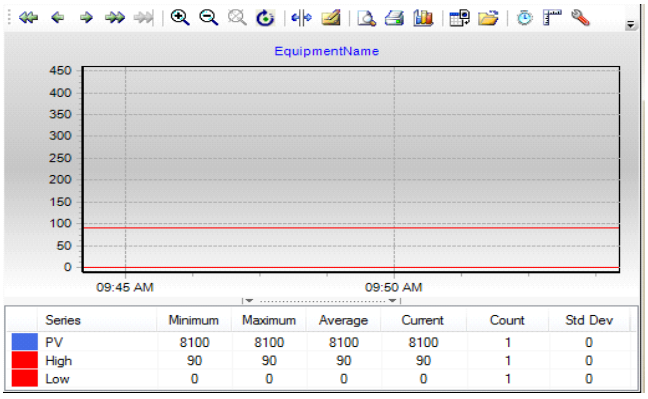
Resources	**Advanced**	**Standard**	**Basic**
Digital Inputs	4		
Digital Outputs	0		
Analog Inputs	0		
Analog Outputs	0		
PLC Memory Steps	214		
System Words Used	16		
System Bits Used	133		
SCADA SCAN Points	13		

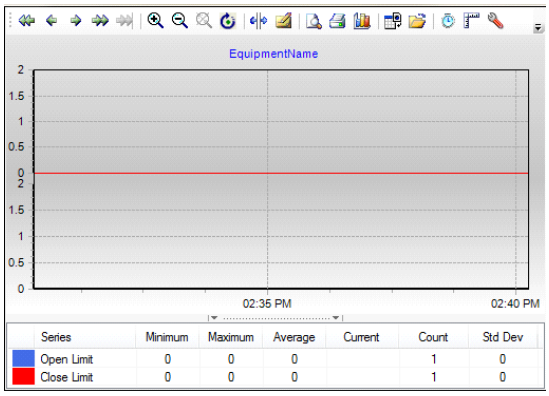
Template: Advanced Totalizer PLC Function Block



Template Graphic: Advanced Home Screen	Control	Descriptions
	# Equipment ID	Totalizer controlled name
	Live Total PV	Current total of totalizer
	Last Total PV	Last total saved when reset occurred
	High High	High-high alarm indication
	High	High alarm indication
	Low	Low alarm indication
	Low Low	Low-low alarm indication
	Overflow	Over range alarm
	Underflow	Under range alarm
	Interlock Fault	Alarm fault latch
	Reset	Reset the Totalizer after a fault has been repaired

Template Graphic: Advanced Alarms & Events Screen	Control	Descriptions
	Alarms	Display all the alarms filtered for the current Digital Output
	Events	Display all the events filtered for the current Digital Output.
	Local Acknowledge	Acknowledge all the alarms on locally on the current machine
	Global Acknowledge	Acknowledge all the alarms on globally on all the machines.

Template Graphic: Advanced Trend Screen	Control	Descriptions
	Equipment Name	Display the name of the current analog Input of the trend
	PV	Display the level of the current level
	High	High Setpoint for analog scaled value
	Low	Low Setpoint for analog scaled value

Template Graphic: Advanced Trend Screen	Control	Description
	Equipment Name	Display the current valve name of the trend.
	Open limit	Display the status of the open limit of the valve
	Close Limit	Display the status of the close limit of the valve

14.2.10 Vessel MAPS Template (Instrumentation)

The Vessel MAPS template is designed to control a vessel that is connected to digital and/or analog level control units.

This MAPS template is available in three models – advanced, standard and basic, which provide respectively lower levels of control over the vessel.

This describes the Advanced Vessel MAPS Template and also defines the level of functionality provided by the standard and basic models. So that you can decide which model best suits your needs. You should consider the following factors in your choice:

- the importance of the vessel being controlled and
- the budget of the customer

Since the more complex the model, the greater the required PLC memory usage; number of PLC I/O and SCADA size (scan points) - see the **Resources** table below.

NOTE: The version 2 (v2) Vessel (Advanced and Standard) MAPS template, communicates Floating point values instead of Integer values to the driver.

Advanced Vessel Functional Philosophy

The vessel is filled according to the level field inputs received.

Field inputs

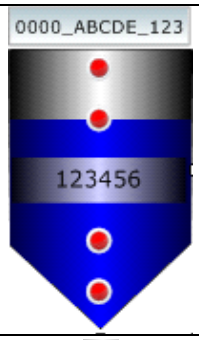
- High-high Level
- High Level
- Low Level
- Low-low Level
- Analog level Input

Simulation mode: overrides inputs to the vessel and simulates a level in the PLC program that is controlled from the faceplate. This is used to test the process logic without receiving the physical input itself, which is very useful in testing, commissioning and maintenance.

Alarming: the analogue input of the vessel function block has four alarm setpoints, each of which can be enabled independently and which behave as follows:

- The High warning alarm and High-high alarm will trigger once the process value exceeds the alarm setpoint value.
- The Low warning alarm and Low-low alarm will trigger once the process value falls below the alarm setpoint value.
- The High warning alarm will reset once the process value falls below the High setpoint value by the alarm hysteresis value
- The Low warning alarm will reset once the process value increases above the Low setpoint value by the alarm hysteresis value.
- The High-high and Low-low alarms will reset once the process value is out of the alarm range and the operator has acknowledged the alarm with the reset button on the faceplate.

Typical Faceplate Graphics for the Advanced Vessel MAPS Template

Vessel	
	
	Level Indication (High-high, High, Low and Low-Low)
	Analog level Indication Value
	Control / Tag Name
Graphics legend:	
Fill colour	**Vessel Status**
Grey	Empty Level
Blue	Analog level fill indication

Signal Description		**Agent Type**	**Advanced**	**Standard**	**Basic**
SCADA Control Words:					
SSCL 0	Control Word	**Marshal**	**x**	**x**	**x**
SSCL 1	High-high Level	**Analog**	**x**	**x**	
SSCL 2	High Level	**Analog**	**x**	**x**	
SSCL 3	Low Level	**Analog**	**x**	**x**	
SSCL 4	Low-low Level	**Analog**	**x**	**x**	
SSCL 5	Scale Min In Setpoint (Raw Min)	**Analog**	**x**	**x**	
SSCL 6	Scale Max In Setpoint (Raw Max)	**Analog**	**x**	**x**	
SSCL 7	Scale Min Out Setpoint (Eng. Min)	**Analog**	**x**	**x**	
SSCL 8	Scale Max Out Setpoint (Eng. Max)	**Analog**	**x**	**x**	
SSCL 9	Simulation Value	**Analog**	**x**	**x**	
SSCL 10	Alarm Hysteresis	**Analog**	**x**	**x**	

Signal Description		**Agent Type**	**Advanced**	**Standard**	**Basic**
SCADA Status Words:					
SSSL 0	Status Word	**Marshal**	**x**	**x**	**x**
SSSL 1	Vessel Process Value (Scaled Value)	**Analog**	**x**	**x**	
SSSL 2	Vessel RAW Value (Analog Raw Value)	**Analog**	**x**	**x**	
Digital Inputs:			**Advanced**	**Standard**	**Basic**
DI 0	High-high Level		**x**		**x**
DI 1	High Level		**x**		**x**
DI 2	Low Level		**x**		**x**
DI 3	Low-low Level		**x**		**x**
Analog Input:			**Advanced**	**Standard**	**Basic**
AI 0	Analog Input for Vessel Level		**x**	**x**	

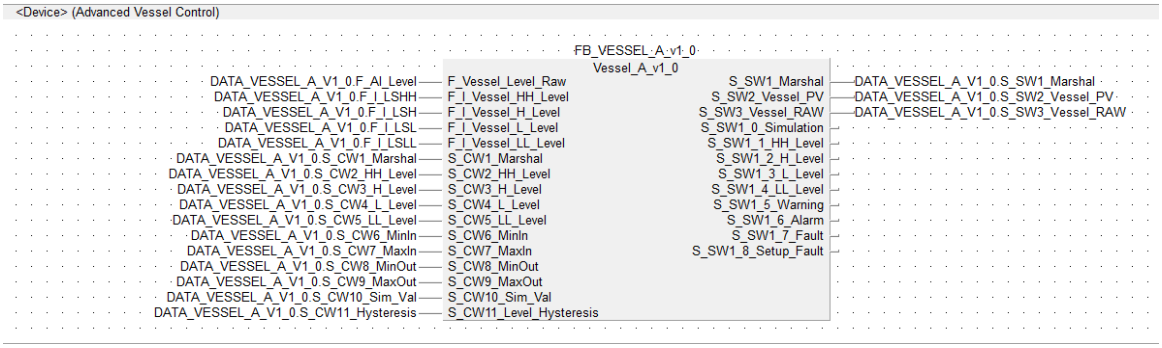
SCADA Control Word (Adroit Marshal Agent)	**Event Logged**	**Advanced**	**Standard**	**Basic**

Bit 0	Simulation	x	x	x	x
Bit 1	High-high AI Level Enabled	x	x	x	
Bit 2	High AI Level Enabled	x	x	x	
Bit 3	Low AI Level Enabled	x	x	x	
Bit 4	Low Low AI Level Enabled	x	x	x	
Bit 5	Reset Fault		x	x	x
Bit 6	High-high DI Level Enabled	x	x		x
Bit 7	High DI Level Enabled	x	x		x
Bit 8	Low DI Level Enabled	x	x		x
Bit 9	Low-low DI Level Enabled	x	x		x
Bit 10	Spare				
Bit 11	Spare				
Bit 12	Spare				
Bit 13	Spare				
Bit 14	Spare				
Bit 15	Spare				

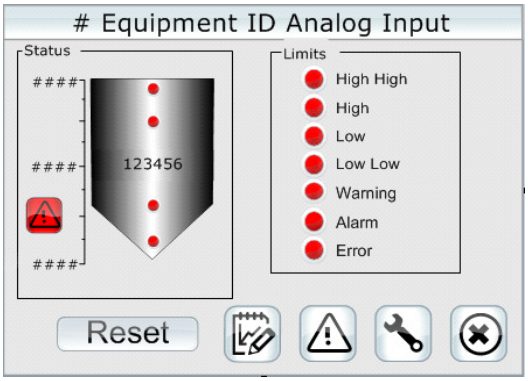
SCADA Status Word (Adroit Marshal Agent)		Alarmed	Advanced	Standard	Basic
Bit 0	Simulation On		x	x	x
Bit 1	High-high Level Active	x	x	x	x
Bit 2	High Level Active	x	x	x	x
Bit 3	Low Level Active	x	x	x	x
Bit 4	Low-low Level Active	x	x	x	x
Bit 5	Level Warning	x	x	x	x
Bit 6	Level Alarm	x	x	x	x
Bit 7	Level Fault Latch		x	x	x
Bit 8	Level Setup Fault		x	x	
Bit 9	Spare				
Bit 10	Spare				
Bit 11	Spare				
Bit 12	Spare				
Bit 13	Spare				
Bit 14	Spare				
Bit 15	Spare				

Resources	Advanced	Standard	Basic
Digital Inputs	4	0	4
Digital Outputs	0	0	0
Analog Inputs	1	1	0
Analog Outputs	0	0	0
PLC Memory Steps	384	366	135
System Words Used	40	40	0
System Bits Used	76	72	62
SCADA SCAN Points	14	14	2

Template: Advanced Vessel PLC Function Block

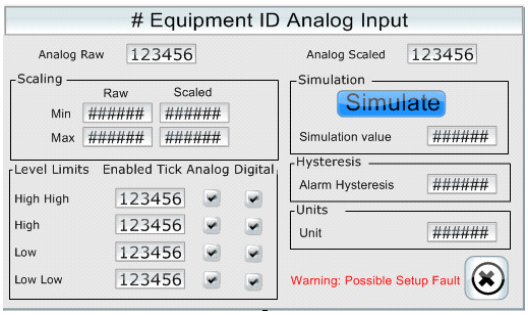


Template Graphic: Advanced Home Screen

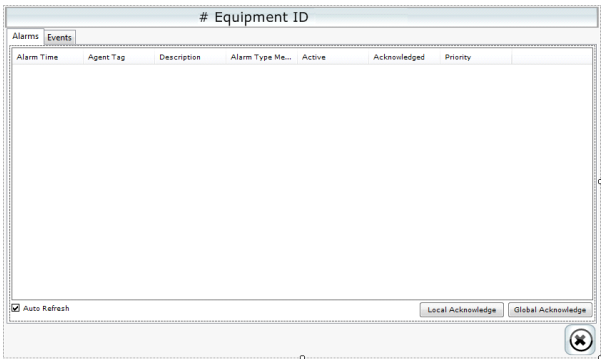


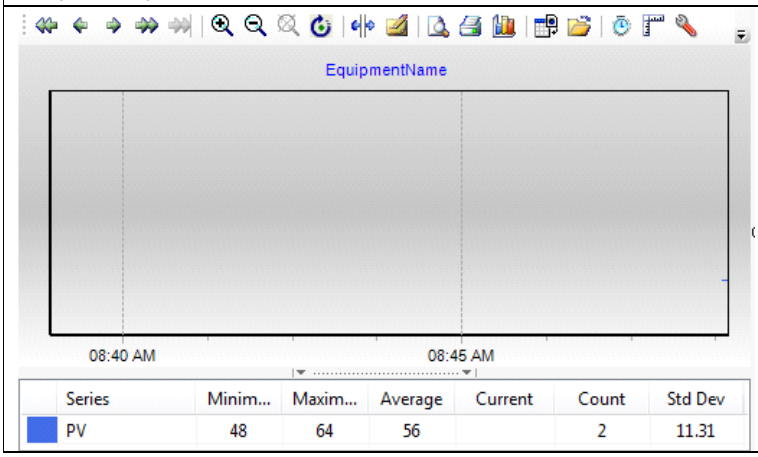
Control	Descriptions
# Equipment ID	Vessel controlled name
High High	High-high alarm indication
High	High warning indication
Low	Low warning indication
Low Low	Low-low alarm indication
Warning	Low, high alarm warning
Alarm	Low-low, high-high alarm fault
Error	Alarm fault latch
Reset	Reset the vessel after a fault has been repaired
123456	Analog scaled value indication
	Digital level indication
	Alarm fault latch

Template Graphic: Advanced Setup Screen



Control	Descriptions
Simulate	Enable simulation of vessel, disables the physical output
Simulation Value	Simulation value of vessel
Analog Raw	Raw value from field level
Analog Scaled	Scaled value from field level
Min, Max Raw	Raw level input values for scaling
Min, Max Scaled	Engineering level values for scaling
High High	High-high alarm setup value and enabling analog and Digital Inputs
High	High alarm setup value and enabling analog and Digital Inputs
Low	Low alarm setup value and enabling analog and Digital Inputs
Low Low	Low-low alarm setup value and enabling analog and Digital Inputs
Alarm Hysteresis	High and low analog level auto reset hysteresis value
Unit	Unit displayed for the scaled level of the vessel

Template Graphic: Advanced Alarms & Events Screen	Control	Descriptions
	Alarms	Display all the alarms filtered for the current Digital Output
	Events	Display all the events filtered for the current Digital Output.
	Local Acknowledge	Acknowledge all the alarms on locally on the current machine
	Global Acknowledge	Acknowledge all the alarms on globally on all the machines.

Template Graphic: Advanced Trend Screen	Control	Descriptions
	Equipment Name	Display the name of the current vessel of the trend
	PV	Display the level of the current level

These are the standard templates that are currently supplied with the MAPS software, more templates will be added later.