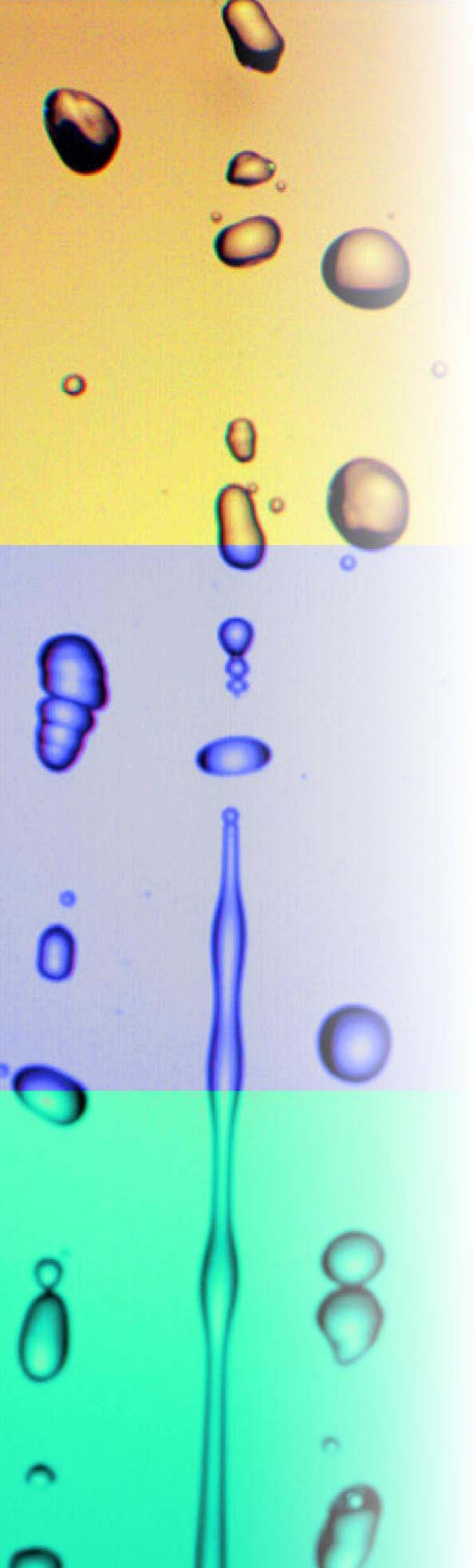

Winnipeg

THE CITY OF WINNIPEG WATER TREATMENT PLANT

STANDARD CONTROL AND FUNCTIONALITY SPECIFICATION

Project No. 79538–02

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CH2MHILL

EarthTech
A Tyco International Ltd. Company

uma

Frederickson Cooper
ARCHITECTS
10-365 Berry St. Winnipeg, Manitoba

RECORD OF AMENDMENTS

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01	**11/04/07**	**N TOULSON**			**Document updated in line with comments from OC and City**

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1. AUTOMATIC CONTROL FUNCTIONALITY

.1 The purpose of this document is to specify the functionality required to be provided by the control system. The control system is made up of the PLC's and the various HMI located throughout the plant.

.2 The PLC's have the function of controlling the various plant and equipment throughout the Works to meet the process requirements.

.3 The following descriptions of control functionality shall be incorporated into the PLC programming.

.1 Control & Monitor Fixed and Variable Speed Drives

.2 Control &Monitor Electrical Switchgear and Protection Devices

.3 Control & Monitor Actuated Valves

.4 Control & Monitor Solenoid Valves

.5 Condition Analogue Signals and set alarms

.6 Condition Digital Signals and set alarms

.7 Undertake Duty selection, rotation and auto changeover to standby.

.8 Undertake PID Loop Control

.9 Totalise Pulses for transfer to SCADA/HMI

.10 Generate PLC Latched Faults

.11 Monitor PLC/SCADA/HMI & PLC/PLC communications

.12 Monitor Electrical Distribution System

.4 The fundamental design concept shall be that the plant/equipment reverts to a safe state (no danger to personnel) in the event of broken/loose wire connections of Real I/O and in the event of failure of any PLC.

.5 The following sections describe the detailed control functionality for the above.

.6 Any further required functionality such as extra alarms will be described in the User Requirement Specification (URS).

2. FIXED AND VARIABLE SPEED DRIVES

.1 All Fixed Speed and VSD drives shall be configured in accordance with the following.

2.1 Fixed Speed Drives

.1 The drive can be operated in the following modes

.1 **Automatic** - control is from the PLC control logic

.2 **Remote Manual** - the motor can be controlled manually from the HMI or SCADA

.3 **Local Manual** - the motor can only be controlled from the MCC using the control pushbuttons and switches on the starter door or mounted locally at the drive.

.2 Description of Hardwired Input Signals associated with Fixed Speed Drives

.1 Drive CPU

.1 This is a discrete signal indicating that the COH selector switch mounted at the drive or at the MCC is in CPU mode which will allow Automatic or Remote Manual operation of the drive.

.2 Drive Running/Stopped

.1 The drive is considered to be running if the motor has been “started” and the hardwired signal from the starter contactor is active. In some cases process instrumentation such as a flow meter shall provide positive confirmation that the drive is running, this will be described further in the user specification.

.3 Drive Fault

.1 This can be either a single input from the drive overload protection unit or a single input derived from multiple protection devices associated with the drive.

.1 Low pump suction level

.2 Low pump outlet flow

.3 High stator temperature

.2 These inputs shall be selected for use as appropriate to each drive application. A change in state of the input from healthy shall be used in the PLC logic to trip or inhibit the drive as required.

.3 During start-up of the drive it may be necessary to override certain process interlocks such as low pressure, an adjustable timer will available in the PLC logic for this purpose.

.3 Description of Hardwired Output Signals associated with Fixed Speed Drives

.1 Drive Start/Stop

.1 The drive can be started and stopped in either “Automatic” or “Remote Manual” using the hardwired output from the PLC to the drive starter. Whenever the drive is required to run the output must be maintained

.4 System Setpoints, Status and Alarms

.1 SCADA/HMI Engineer adjustable set points

.1 None

.2 SCADA/HMI Operator adjustable set points

Description	Range
Drive to remote manual	
Drive to automatic	
Drive remote manual start	
Drive remote manual stop	
Reset hours run counter	

.3 SCADA/HMI status signals

Description	Range
Drive running	
Drive stopped	
Drive automatic	
Drive remote manual	
Drive local manual control indication	
Drive fault	
Drive hours run	

.4 SCADA/HMI alarm signals

Description	Range
Drive general fault	

2.2 Variable Frequency Drives (VFD)

.1 Variable Frequency Drive Features

.1 Each VFD motor starter contains an inverter, and an Operator interface panel. Some drives are connected to the control system with an Ethernet connection which can be used to provide added functionality which will be described below. Other drives are hardwired to the control system; this will also be described below.

.2 Local control is available by using the Operator interface panel to start/ stop the drive and raise/ lower the motor speed.

.3 The drive can be operated in the following modes

.1 **Automatic**- control is from the PLC control logic

.2 **Remote Manual**- the motor can be controlled manually from the HMI or SCADA

.3 **Local Manual**- the motor can only be controlled from the operator interface panel on the starter door.

.2 Drive connected with Hardwiring I/O Requirements

.1 Hard Wired Signals to/from VFD

Description	Type	Active State
Drive CPU	DI	0
Drive Running/Stopped	DI	1
Drive Fault	DI	0
Drive Start	DO	1
Drive Required Speed	AO	
Drive Speed	AI	

.3 Drive connected with Ethernet I/O Requirements

Description	Type	Active State
Running Speed		
Running Current		
Inverter Running	Bool	1
Drive Available	Bool	0

.4 Description of Hardwired Input Signals associated with VFD'S

.1 Drive CPU

.1 This is a discrete signal indicating that the Operator interface panel mounted at the drive or at the MCC is in CPU mode which will allow Automatic or Remote Manual operation of the drive.

.2 Drive Running/Stopped

.1 The drive is considered to be running if the motor has been "started" and the hardwired signal from the starter contactor is active. In some cases process instrumentation such as a flow meter shall provide positive confirmation that the drive is running, this will be described further in the user specification.

.3 Drive Fault

.1 This can be either a single input from the drive overload protection unit or a single input derived from multiple protection devices associated with the drive.

.1 Low pump suction level

.2 Low pump outlet flow

.3 High stator temperature

.2 These inputs shall be selected for use as appropriate to each drive application. A change in state of the input from healthy shall be used in the PLC logic to trip or inhibit the drive as required.

.4 Drive Speed

.1 Once the drive is started and confirmed as "running" and a required speed has been sent to the VFD, this 4-20ma signal will confirm that the drive is running at the correct speed.

.5 Description of Hardwired Output Signals associated with VFD'S

.1 Drive Start/Stop

.1 The drive can be started and stopped in either "Automatic" or "Remote Manual" using the hardwired output from the PLC to the drive starter. Whenever the drive is required to run the output must be maintained

.2 Drive Required Speed

.1 Once the drive is started and confirmed as "running" the required speed will be outputted by the control system in the form of a 4-20ma signal. The required speed will either be calculated by the PLC when in "automatic mode" or selected by the operator if the drive is in "remote manual" mode.

.6 System Setpoints, Status and Alarms

.1 SCADA/HMI Engineer adjustable set points

Description	Range
Drive maximum speed	0-100%
Drive mininum speed	0-100%

.2 SCADA/HMI Operator adjustable set points

Description	Range
Set Speed	0-100%
Drive to remote manual	
Drive to automatic	
Drive remote manual start	
Drive remote manual stop	
Reset hours run counter	

.3 SCADA/HMI status signals

Description	Range
Drive running	
Drive stopped	
Drive automatic	
Drive remote manual	
Drive hours run	
Drive current	0-999% FLC
Drive Speed	0-100 %

.4 SCADA/HMI alarm signals

Description	Range
Drive general fault	
Drive overtemperature (where applicable)	
Drive set speed exceeded max/min	

2.3 Variable Speed Drives (VSD)

.1 Variable Speed Drive Features

.1 These drives generally have the same functionality as the VFD drives but the speed is not controlled by an inverter. Instead a variable magnetic coupling is used; the speed of the drive is controlled by varying the gap in the magnetic coupling. The gap distance is altered with an electric actuator. The same control functions apply.

3. ACTUATED VALVES AND PENSTOCKS

.1 All actuated valves and penstocks shall be connected to the PLC using hardwiring. The control and monitoring of each actuator shall be configured as follows.

3.1 Valve I/O Requirements

.1 Depending on valve type, open/ close or modulating the following I/O shall be available.

.2 Signals from Actuator to PLC

Description	Type	Active State
CPU Mode Selected	DI	1
Closed limit switch	DI	1
Open Limit Switch	DI	1
Position	AI	

.3 Signals from PLC to Actuator

Description	Type	Active State
Close	DO	1
Open	DO	1
Emergency shutdown	DO	1
Required Position	AO	

3.2 Description of Signals from Actuator to PLC

.1 CPU Mode Selected

.1 The actuator has a 3 position switch for selecting CPU, Local Stop or Hand Control. The switch passes from CPU to Local, or Local to CPU, through the Local Stop position. When the actuator local control switch is fully in the CPU position then this input is set to logic 1. This input is not present when the actuator control switch is in the Local Stop or Hand positions. The input is present as long as the switch is in the CPU position and it will clear only when the switch is returned to the Hand or Local Stop position.

.2 Close Limit Switch/ Open Limit Switch

.1 There are two limit switches relating to the actuator set positions for open and close positions. These limit positions may be set within the actual valve stroke. When the actuator reaches either the open or closed position the input will be set to logic 1.

.3 Valve Position

.1 A 4-20 mA analogue signal proportional to the valve position where 4 mA is closed and 20 mA is fully open.

.4 Description of Signals from PLC to Actuator

.1 Stop (Stay Put)

.1 A command issued to make the actuator stop moving if it has been requested to do so.

.2 Close/ Open

.1 Commands issued to move the valve open or closed between limits. Operation continues until the desired limit is reached or a new command is issued, to enable this to happen the signal has to be present until the position is reached and confirmed by the feedback.

.3 Emergency Shutdown

.1 An ESD command will override both the local control and any auxiliary remote commands and cause the valve go to a predetermined position.

.4 Required Position

.1 A 4-20 mA analogue signal proportional to the valve required position where 4 mA is closed and 20 mA is open.

.5 Description of Derived Signals associated with Actuators

.1 Actuator Fault

.1 If a valve is available for either automatic or remote manual operation and it is commanded to move in either direction, but fails to do so within the time set by the Engineer, then a valve fault alarm will be displayed on the SCADA/HMI.

3.3 System Setpoint, Status and Alarms

.1 SCADA/HMI Engineer adjustable set points

Description	Range
Valve Failed To Open/Close time (as required x seconds)	
Valve Control Deadband (typically 2%) – Modulating valve only	
Valve Failed To Move time (as required x seconds) – Modulating valve only	
Valve action on loss of signal	

.2 SCADA/HMI Operator adjustable set points

Description	Range
Valve automatic	
Valve remote manual	
Valve Open	
Valve Close	
Valve Required Position	

.3 SCADA/HMI status signals

Description	Range
Valve automatic	
Valve opened	
Valve closed	
Valve remote manual	
Valve Position	0-100%

.4 SCADA/HMI alarm signals

Description	Range
Failed to open	
Failed to close	
Valve position outside limits	

4. SOLENOID VALVES

4.1 Valve I/O Requirements

Description	Type	Active state
Open	DO	1

.1 No position feedback is available from solenoid valves and failure is not monitored. Status of the valve i.e. opened or closed is inferred from the PLC output. i.e.. (Opened = logic ‘1', Closed = logic ‘0’)

.2 Where available, flow and pressure switches may be used to check the status of the solenoid. For example, if the solenoid open output was set, but the flow switch had not detected a flow, an alarm may be generated.

4.2 Valve Control

.1 No facilities to operate a solenoid valve in remote manual mode from the SCADA/HMI/HMI has been provided.

4.3 Valve Monitoring

.1 No additional monitoring shall be performed by the PLC

4.4 System Setpoints, Status and Alarms

.1 SCADA/HMI Engineer adjustable set points

.1 None

.2 SCADA/HMI Operator adjustable set points

.1 None

.3 SCADA/HMI status signals

.1 Open / Close Commands

.4 SCADA/HMI alarm signals

.1 None

5. ANALOGUE SIGNAL PROCESSING

.1 All Analogue signals shall be configured in accordance with the following.

5.1 I/O Requirements

Description	Type	Active state
Instrument Fault (If Installed)	DI	0
Instrument Signal	AI	0-20mA

.1 Instrument Fault

.1 This is a composite signal sourced from the instrument indicating any general fault present. e.g. loss of echo.

.2 Instrument Signal

.1 This is an analogue signal, sourced from associated transmitter and represents the process value as range 0 – 20mA.

5.2 Control Requirements

.1 As described in the User Requirement Specification for each instrument.

5.3 Signal Monitoring

.1 Signal Scaling

.1 All analogue signals inputted to the PLC shall be raw values. Scaling of the signal into engineering units shall not be performed in the PLC. Any scaling shall be carried out in the SCADA/HMI.

.2 Signal Validation

.1 All analogue input modules shall be configured to read 0 – 20 mA signals. Checks shall be performed by the PLC to ensure the signal is valid. If the signal falls outside a nominal range (<3.5mA, >20.5mA) for a configurable time, then a signal ‘Out of Range’ alarm shall be generated.

.2 When the alarm state has cleared (i.e. the signal has returned within range) for a pre set time, the PLC alarm shall clear. The alarm shall be set for the duration of the fault and shall not be latched.

.3 When an analogue signal is determined out of range, the ‘conditioned' signal shall not be updated. Conditioned signals may be frozen at their current values, set to zero or set to 100 % depending on application.

.3 Instrument Failure

.1 Where applicable the instrument shall be monitored for failure. If the Failed signal is detected for a configurable time, then a signal 'Failed' alarm shall be generated.

.2 When the alarm state has cleared (i.e. the instrument has returned healthy) for a pre set time, the PLC alarm shall clear. The alarm shall be set for the duration of the fault and shall not be latched.

.3 When an instrument is deemed failed, the 'conditioned' signal shall not be updated. Conditioned signals may be frozen at their current values, set to zero or set to 100 % depending on application.

.4 Process Alarms

.1 Alarm states shall be configured for High High, High, Low and Low Low conditions, where required. The set points for the alarm states shall be set through the HMI or SCADA/HMI.

.2 A reset deadband shall be a PLC configurable value and shall be applied to each alarm setpoint. The deadband value shall apply below High and High High alarm setpoints and above Low and Low Low alarm setpoints.

.3 Rate of change alarms shall also be configured for all analogue signals. The set points for the alarm states shall be set through the HMI or SCADA/HMI.

.4 Alarms shall automatically reset when the alarm condition subsides unless specifically detailed otherwise in the respective FDS sections.

5.4 System Setpoints, Status and Alarms

.1 SCADA/HMI Engineer adjustable set points

Description	Range
Alarm deadband	0-10%
Instrument fault time	0-120 secs
Signal out of range time	0-120 secs
Rate of change time	0-120 secs

.2 SCADA/HMI Operator adjustable set points (Engineer Access)

Description	Range
High high setpoint	
High setpoint	
Low setpoint	
Low low setpoint	

.1 The above shall be configured as applicable

.3 SCADA/HMI status signals

Description	Range
Measured analogue value (units)	
Failed/ normal	
High High	
High	
Low	
Low Low	

.4 SCADA/HMI alarm signals

Description	Range
Instrument failure (where applicable)	
Signal out of range	
High high	
High	
Low	
Low low	
High rate of change	
Low rate of change	

6. DIGITAL PROCESS SIGNALS

.1 All digital process signals such as high/ low level, high low flow and high/ low pressure shall be configured in accordance with the following

6.1 I/O Requirements

Description	Type	Active state
Low Low	DI	0
Low	DI	0
High	DI	0
High High	DI	0

.1 Low Low, Low, High, High High

.1 This is a discrete signal from a device such as a level switch or flow switch. Generally only one signal level shall originate from each device. The device shall be wired to the PLC inputs or remote I/O or directly to an MCC starter when used as a drive process protection device. The device will be selected and configured to work in a fail safe manner, i.e. “open to alarm”

6.2 Control Requirements

.1 As described in the main Functional Design Specification for each instrument.

6.3 Signal Monitoring

.1 Signal Overrides

.1 In some instances such as low flow protection for a pump it will be necessary to override the signal during the initial process startup. This can be done in software as in the case of signals wired to protection devices units or the PLC, or alternatively using hardware timer relays.

.2 Instrument Failure

.1 It is not normally possible to monitor this type of device for failure.

.3 Process Alarms

.1 Alarm states shall be set against High High, High, Low and Low Low conditions, where required. The set points for the alarm states shall be defined by the installation or calibration of the device, ie. the length of conductivity probe or pressure trip setting on a pressure switch.

.2 Alarms shall automatically reset when the alarm condition subsides unless specifically detailed otherwise in the respective FDS sections.

6.4 System Setpoints, Status and Alarms

.1 SCADA/HMI Engineer adjustable set points

Description	Range
Signal override time	0-30secs

.2 SCADA/HMI Operator adjustable set points (Engineer Access)

.1 None

.3 SCADA/HMI status signals

.1 None

.4 SCADA/HMI alarm signals

Description	Range
High high	
High	
Low	
Low low	

7. DUTY STANDBY SELECTION

7.1 Duty/Standby Operation

.1 The PLC, when required, shall run the drive selected as Duty. Should the Duty drive be unavailable then the PLC shall run the Standby drive and generate an alarm.

.2 Should the failed Duty drive become available the PLC shall stop the Standby (if running), run the Duty drive as required and cancel the alarm.

7.2 Duty/Assist Operation

.1 The PLC, when required, shall run the drive selected as Duty. Dependant upon process conditions the PLC shall start and stop the Assist drive.

.2 Staggered starting shall be applied to Duty and Assist drives in the event of process conditions requiring both drives

.3 The Assist drive shall act as a Standby drive, as above, in the event of Duty drive unavailability.

7.3 Duty/Assist/Standby Operation

.1 This shall be generally as above with the Standby able to replace either the Duty or Assist drive functionality.

7.4 Duty Selection / Auto Rotation

.1 A facility shall be provided to allow the duty allocation for equipment to re-assigned either manually or automatically.

.2 Each drive/unit shall be allocated individual ‘Duty cycle’ time periods (hours). These time periods can be allocated so as to optimise the operation the equipment.

.3 The PLC shall monitor the actual hours run for the respective duty drive and when this exceeds the allocated ‘Duty cycle’ time period automatic duty rotation shall occur. In certain applications it may be necessary to wait until ideal plant conditions exist before allowing rotation to be performed (e.g. both drives stopped).

.4 The facility to manually re-select a new duty drive shall be provided at the SCADA/HMI.

7.5 System Setpoints, Status and Alarms

.1 SCADA/HMI Engineer adjustable set points

.1 None

.2 SCADA/HMI Operator adjustable set points (Operator Access)

Description	Range
Drive A Duty Cycle Time	0-168 hrs
Drive B Duty Cycle Time	0-168 hrs
Drive C Duty Cycle Time	0-168 hrs
Drive A Manual Duty Selection	
Drive B Manual Duty Selection	
Drive C Manual Duty Selection – if applicable	

.3 SCADA/HMI status signals

Description	Range
Drive A Duty Status	
Drive B Duty Status	
Drive C Duty Status – if applicable	
Duty Drive Accumulated Run Time (Hours)	

.4 SCADA/HMI alarm signals

.1 None

8. PROPORTIONAL, INTEGRAL AND DERIVATIVE LOOP CONTROL

.1 Where specified in the User Requirement Specification (URS) the PLC shall perform closed loop PID control with all relevant parameters displayed and configurable at the associated HMI and SCADA/HMI.

.2 General

.1 PID loops shall have the following parameters and facilities within the PLC software

.2 Set Point value (Manual) (SPM): set by the operator at the HMI or SCADA/HMI.

.3 Set Point value (Remote) (SPR): set by the PLC software (e.g.. Sodium Hypochlorite control system has ‘n’ No. set points automatically input by the PLC).

.4 Set Point value (Working) (SP): the actual set point being used (i.e. either SPM or SPR or tracked value) by the PID controller at the current time.

.5 Process Variable (PV): is the signal from the process monitor (e.g. 4-20mA level, Chlorine Residual, flow signal)

.6 Error (ER): value between the PID's current set point (SP) and the Process Variable PV.

.7 Control Variable (CV): is the output from the PID controller (e.g.. 4-20mA blower speed command signal)

8.1 PID Control Modes

.1 The PID controller within the PLC software has an automatic and manual mode of operation as follows:-

.2 Manual Mode

.1 When in manual mode the PLC shall:-

.1 Write the manually adjusted loop output (e.g. manual speed) to the PID loop CV.

.2 Make the output to the drive/ device track the CV

.3 Make the set point SP track the PV.

.3 Automatic Mode

.1 When in Automatic mode the PID shall:-

.1 Set the set point mode to the pre-selected default i.e. (remote) or (manual).

.2 Set the set point (SP) to default mode (remote) or (manual) value, following any set point ramping requirements.

.3 Apply PID algorithm to the Error to calculate the required CV to achieve the SP.

.4 Make the output to the drive/ device track the CV.

.5 The PLC shall check the difference between the desired flow set-point and the PID loop set-point.

.6 If the difference is less than the ramp value (value required), then the PID loop set-point shall equal the desired set-point. However, if the difference is greater than the ramp then the PLC shall automatically adjust the PID loop set-point by the ramp value over a time period until the difference between the desired value and the PID set-point is less than the ramp value.

.4 Bump-less Man/Auto Transfer

.1 To prevent sudden surges in controller output, when changing from manual to automatic mode the PID shall,

.2 Instantaneously set the set point mode to the pre-selected default i.e. (remote) or (manual)

.3 Begin ramping (over a fixed rate of change set in the PLC) the working set point (SP) to the required set point value for the default mode. The rate of change shall be adjusted via the PLC programming tool to suit the PID control loop conditions during commissioning.

.4 Apply PID algorithm control to Error to calculate the CV.

.5 PID loss of PV signal

.1 If the PV signal to the PID controller goes Out Of Range, the PID controller shall be set to the Manual Mode and the loop output shall be frozen at the last value. When the Out Of Range state is cleared the PID controller shall be set to the automatic mode.

8.2 System Setpoints, Status and Alarms

.1 SCADA/HMI Engineer adjustable set points

Description	Range
PID Loop Set Point,	
Manual/Auto Mode Selection,	
Proportional Gain	
Integral Time	
Derivative Time	
Loop Manual CV	
Deadband	

.2 SCADA/HMI Operator Adjustable Setpoints

.1 None

.3 SCADA/HMI Status

Description	Range
PID Loop Set Point,	
Manual /Auto Mode	
Proportional Gain	
Integral Time	
Derivative Time	
PID Loop CV	
PID Loop PV	

.4 SCADA/HMI Alarms

.1 None

9. TOTALISATION OF PULSES

.1 Where specified in the URS, the PLC shall totalise quantities from field devices such as kWh meters, flow meters etc. the PLC shall totalise pulses from the device.

.2 The cumulative value shall be stored in the PLC and transferred to the SCADA/HMI for display and reporting purposes.

.3 Totalised values shall be upto 7 digits i.e 9999999 units and shall auto reset to zero if exceeded. A facility shall be provided at SCADA/HMI to allow the cumulative total to be reset manually.

.4 Units shall be configured as engineering values.

9.1 System Setpoints, Status and Alarms

.1 SCADA/HMI Engineer adjustable set points

.1 None

.2 SCADA/HMI Control Signals (Engineer Access)

.1 Manual reset

.3 SCADA/HMI Status

.1 Total value

.4 SCADA/HMI Alarms

.1 None

10. PLC LATCHED FAULTS

.1 The PLC shall monitor the condition of plant and equipment and shall set the fault status as appropriate. Some fault conditions shall automatically reset when the condition clears e.g. analogue signals returning within range. Other Faults shall be “latched” in the PLC e.g. drive failed to run and shall thus require to be reset.

.2 Reset functions shall be configured at the SCADA/HMI for each PLC.

.3 A reset shall be configured at each HMI to reset faults in the associated PLC. In the case where no HMI exists then a hardwired reset pushbutton shall be provided.

.4 Reset facilities shall simultaneously reset all associated PLC latched faults.

10.2 System Setpoints, Status and Alarms

.1 SCADA/HMI Engineer adjustable set points

.1 None

.2 SCADA/HMI Operator adjustable set points (Operator Access)

.1 Manual reset

.3 SCADA/HMI status signals

.1 Latched Alarm Present

.4 SCADA/HMI alarm signals

.1 As appropriate

11. ELECTRICAL SYSTEM MONITORING

.1 All power meters shall be connected to Ethernet communications network and the following data will be available for display on the HMI.

11.1 System Setpoints, Status and Alarms

.1 SCADA/HMI Engineer adjustable set points

.1 None

.2 SCADA/HMI Operator Adjustable Setpoints

.1 None

.3 SCADA/HMI Status

Description	Range
Vln a	
Vln b	
Vln c	
Vln average	
Vll a	
Vll b	
Vll c	
Vll average	
I a	
I b	
I c	
kW Total	
kVAR Total	
kVA Total	
Freq	
pf signed	

.4 SCADA/HMI Alarms

.1 None

12. SYSTEM SYNCHRONIZATION AND FAILURES

12.1 Communications

.1 Entire Control System Network

.1 The SCADA/HMI and PLC network shall have a time reset and synchronization command, so that the Engineer can carry out a complete network reset.

.2 SCADA to PLC

.1 The SCADA/HMI system shall have a 'heartbeat' configured between itself and the Master PLC on the network. On loss of communications, the SCADA shall generate an alarm and the PLC shall generate an alarm to telemetry or other agreed systems.

.3 PLC to PLC

.1 Each PLC shall have a 'heartbeat' configured which shall be used to monitor the communications between itself and the other PLCs on the network which it communicates with. On detection of a communications failure, the PLC shall generate an alarm which shall be displayed on the associated HMI and at SCADA. A communication fault between PLC’s shall inhibit plant control in that area where necessary.

.4 PLC to HMI

.1 If a loss of communications is detected by the HMI diagnostic system, an alarm shall be displayed on the HMI