ELECTRICAL
DESIGN
SPECIFICATION

PLC / SCADA / HMI REQUIREMENTS

EL-022

TWEED SHIRE COUNCIL | TOGETHER FORWARD

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1 Citation

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2 Origin of document, Copyright

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3 Versions

VERSION	AMENDMENT DETAILS	CLAUSES AMENDED	DATE ISSUED (The new version takes effect from this date)	Authorised by the Director of Engineering Services
1.0	Original version		23 August 2012	

4 Standards

The equipment and materials supplied under this Specification must comply with the latest relevant Australian Standards, or, in their absence, with the latest relevant IEC Standards, together with the requirements of competent Authorities having jurisdiction over all or part of their manufacture, installation and operation.

In particular, all equipment and materials supplied must comply with the relevant requirements of the following Regulations, Standards and Reference Specifications.

    EL01-3   4.Standards
    EL03-3   4.Standards
    EL14-3   4.Standards

5 CONTROL, PLC PROGRAM STRUCTURE AND NOMENCLATURE

5.1 GENERAL

PLC Logic will be written in Ladder logic. Structured text may be used for complex calculations but will be used in Function Blocks only, which can in turn be called from the ladder program.
Unless otherwise specified the contractor shall supply a licensed copy of all relevant software for PLC's HMI's and any other complementary software required to integrate the system as a whole.

5.1.1 CPU CAPACITY

PLC CPU shall be adequately sized to perform the required task and have a minimum of 60k steps of user program memory capacity, and at completion of programming shall have no less than 25% spare User Memory. CPU shall be a minimum of CS1G-CPU45H or CJ2H-CPU65-EIP.

5.2 PROGRAM STRUCTURE

Program will be structured in line with the P&ID's and set out in an orderly and logical manner corresponding to the process flow.

5.2.1 SEGREGATION

A separate program will be designated for each process, i.e. Inlet works, Chemical Dosing, Effluent outfall etc.
The Principal will supply example programs to the PLC contractor on request.

```
NewProject
    BPWWTP_MCC1A[CS1G-H] Offline
    BPWWTP_MCC1B[CS1G-H] Offline
        Symbols
        IO Table and Unit Setup
        Settings
        Memory
        Programs
            Common_Control (00)
            Inlet (02)
            Pump_Stations (03)
            Bio_Reactor_1B (05)
            Clarifiers (08)
            Dewatering (12)
            Outfall (13)
            Instrumentation (14)
            Data_Exchange (15)
            Special_IO_Setup (16)
            Critical_Alarms (17)
        Function Blocks
```
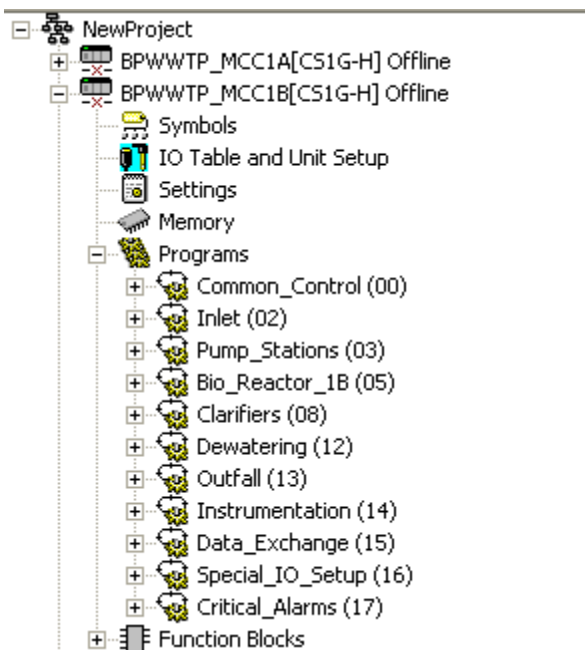
5.2.2 CONTENTS
Each Process program shall be divided into sections containing but not limited to:
1. **Common Control**: Containing logic common to the sub-system process.
2. **Devices**: Each device will have its own section to enable quick location and diagnostics. Device definition shall be any Instrument, Drive or Valve included in the Process.
3. **Alarms**: Containing all separate process alarms not generated by device Function Blocks.
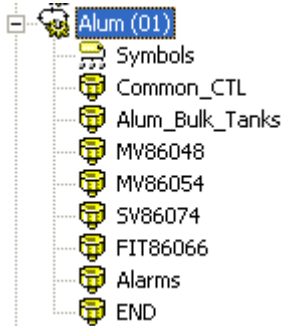
5.2.3 COMMENTS
The PLC Project shall be commented to include:
1. Project Name
2. As built completion date.
3. PLC contractors details
4. Programmers name.
5. Revision History

Each individual Processor will be commented to include:
1. Processor Number
2. Process Description

Each Program will be commented to include:
1. Program description
2. Revision History

Each rung or group of logical rungs within the PLC program (including internal Function Block programs) will include rung comments explaining the function of the subsequent logic. Inadequate commenting shall not be accepted. Example below.

LP860xx Alumt Dosing Modes 2 & 3 (PID Control + Flow Pacing and PID Control + Flow Pacing + Trim).
Calculate PID target SP.
Target (kg/hr) = Operator SP, mg/L, (1 =1mg/L) x PAC Tank Output Flow (L/s) x 36

$$\frac{\text{Target (kg/hr) = Operator SP, mg/L, (1 =1mg/L) x PAC Tank Output Flow (L/s) x 36}}{100}$$

Returns Target value in kg/hr x.1 (1 decimal place).
PID SP is dynamic and directly proportional to the PAC Tank Output Flow.
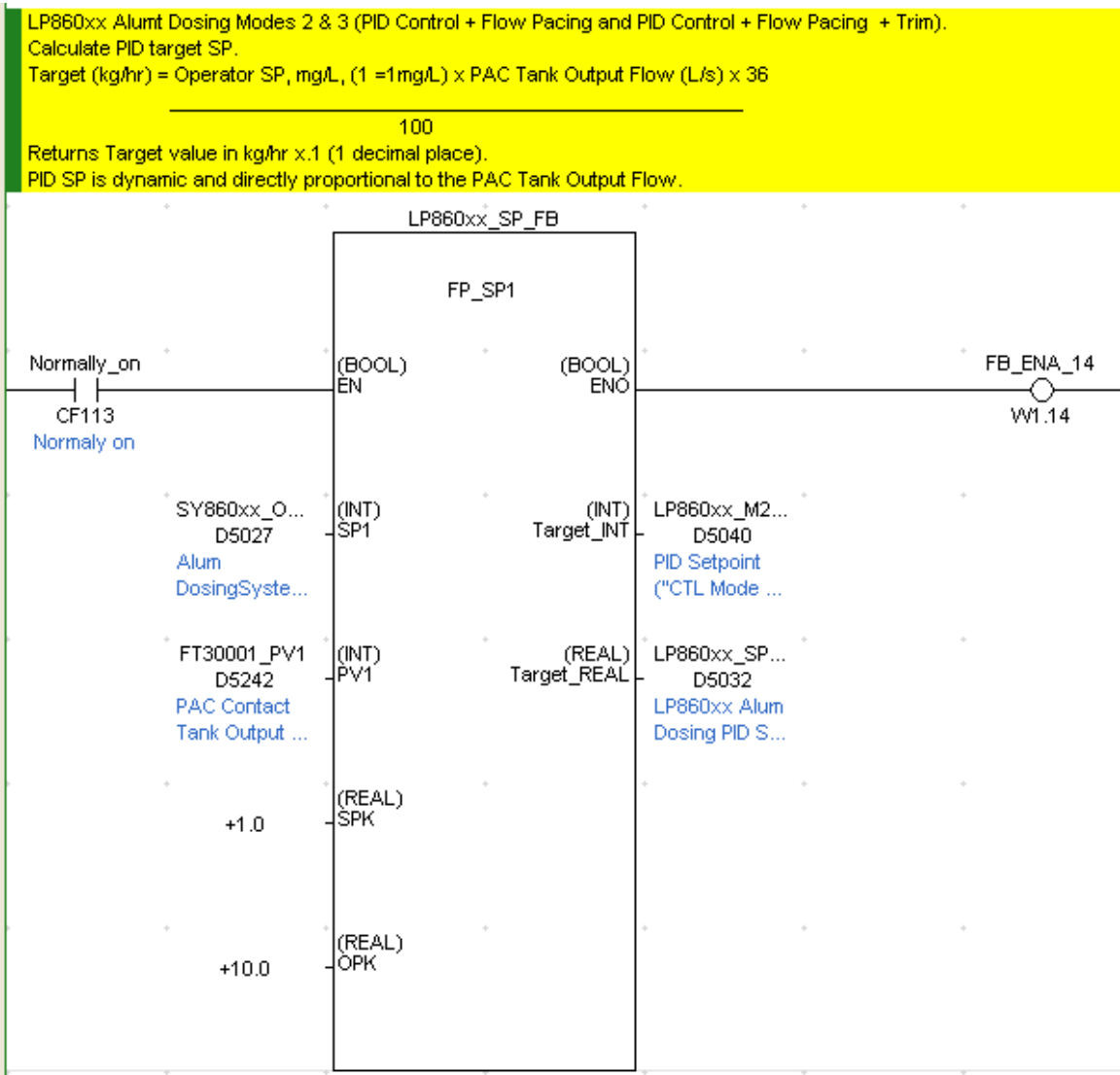
5.3 FUNCTION BLOCKS.

Where repetitive logic is used in the program, Function Blocks shall be used to simplify development and reduce debug time.

The Principal shall free issue a library of standard control Function Blocks to the PLC programming contractor for use in program development. The Principal accepts no liability for loss or damage arising from the use of any PLC code supplied to the contractor.

Where possible the Principals Function Blocks shall be used.

Internal Function Block code shall be commented as per main body with Function description i/o and revision history.

VARIABLE SPEED MOTOR (SITE BPWTP)

Runs a motor from Auto commands or Remote Manual commands provided interlocks are in place
Provides Status (STA) and Alarming (ALM) to SCADA
Takes in previous run times and starts counters and increments during motor operation.

Drive Memory Mapping, (VSD to PLC). 10 Word Array

DRV_MON [0]   Status
DRV_MON [1]   Error
DRV_MON [2]   Output Frequency
DRV_MON [3]   Motor Torque
DRV_MON [4]   Current
DRV_MON [5]   Voltage
DRV_MON [6]   Power
DRV_MON [7]   Drive Thermal State
DRV_MON [8]   Motor Thermal State
DRV_MON [6]   Reserved

Drive Memory Mapping, (PLC to VSD).

DRV_CMD   Control Word
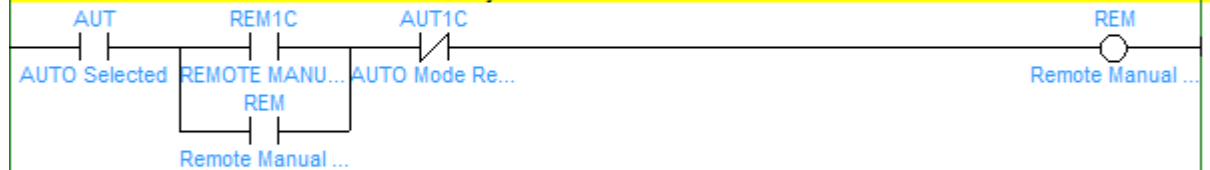DRV_SPDC   Frequency Setpoint.

 Rev | Date | By | Rung | Comment

 0.0 | 11/10/18 | DF | ALL | ClearSCADA re write

Running Indication

K   RNG
┤ ├──○
Hardwired Run ...   Motor Running (...
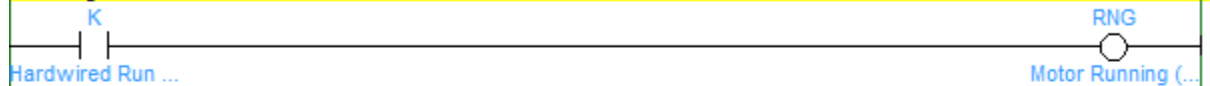
REMOTE MANUAL MODE SELECTION

When selected to AUTO at the MCC the drive may be selected to either AUTOMATIC control or REMOTE MANUAL control via

AUT   REM1C   AUT1C   REM
┤ ├──────┤ ├──────┤/├──○
AUTO Selected REMOTE MANU... AUTO Mode Re...   Remote Manual ...
             REM
            ┤ ├
        Remote Manual ...

****
*********************************** SCADA STATUS SIGNALS ************************************
****
AUTO Selected Status (to SCADA) (Bit 0)

AUT   REM   AUT1
┤ ├──────┤/├──○
AUTO Selected Remote Manual ...   AUTO Selected...

                                                          ┌──────────────┐
                                                          │ OUTB(534)   │
                                                          ├──────────────┤
                                                          │   STA   │
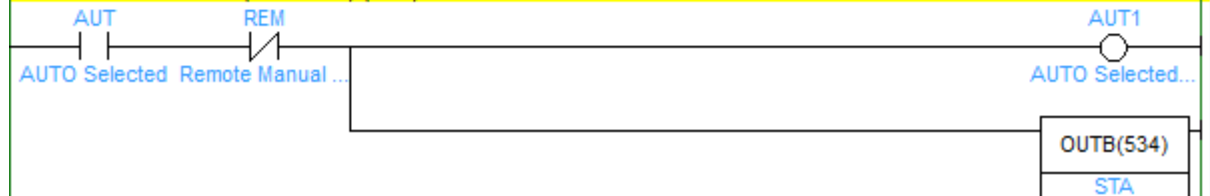
5.4 TAG STRUCTURE

PLC tags shall be structured and maintain a consistent format through the entire project.
Typical tag format shall be:
   ▪ Equipment Number (As defined in P&I Drawings)_Description Function
E.g.: No.1 Chlorinator dosing Flow meter FIT85039 Maintenance Hours = FIT85039_M_HR1Q

All tags will consist of:
   1. PLC Address (Allocated PLC address for each tag)
   2. Tag name (Structured Tag name)
   3. Tag Comment (Detailed comment describing the function of the tag)
   E.g.: **PLC address**, D1924,
       Tag name FIT85039_LTRIP1C
       Tag Comment: No.1 Chlorinator dosing Flow meter FIT85039 Low Alarm Set point.

5.5 TAG DEFINITIONS

5.5.1 STANDARD EQUIPMENT (Tag Prefix) or as defined in P&ID's

Standard Equipment	
CVxxx_	Control valve
FCVxxx_	Flow Control valve
SVxxx_	Solenoid valve
MFxxx_	Motor (Fixed Speed)
MVxxx_	Motor (Variable Speed)
LPxxx_	PID Loop Controller
FSxxx_	Flow Switch
LSHxxx_	Limit Switch High
LSHHxxx_	Limit Switch High
LSLxxx_	Limit Switch Low
LSLLxxx_	Limit Switch Low
PSxxx_	Pressure Switch
ISxxx_	Current sensing device
PPxxx_	Pneumatic Pump
Qxxx_	Circuit Breaker

5.5.2 INSTRUMENTATION (Tag Prefix) or as defined in P&ID's

Instrumentation	
AITxxx_	Analytical instrument
LITxxx_	Level Indicating instrument
FITxxx_	Flow Indicating instrument
TITxxx_	Temperature Indicating instrument
PITxxx_	Pressure Indicating instrument
DPITxxx_	Differential Pressure Indicating instrument
WITxxx_	Weight Indicating instrument

5.5.3 PID Loops (Tag Suffix)

PID Loops		
_SP1	Set point	Integer
_PV1	Process Variable	Integer
_MV1	MV Loop Output	Integer
_P1C	Proportional Gain SP	Integer
_TI1C	Integral Time SP	Integer
_TD1C	Differential Time SP	Integer
_YMAX1C	Set point HLMT SP	Integer
_YMIN1C	Set point LLMT SP	Integer
_YMAN1C	MVOutput Man SP	Integer
_YMAN1C	MVOutput Man SP	Integer
_DVTRIP1C	Deviation Alarm SP	Integer
_ST1C	Sample Time	Integer
_AUT1	LP Output Mode is Auto	Bit
_MAN1	LP Output Mode is Manual	Bit
_DVALM1	Deviation Alarm	Bit
_AUT1C	LP Auto mode Request	Bit
_MAN1C	LP Manual mode Request	Bit

5.5.4 POWER MONITORING (Tag Suffix)

Power Monitoring		
_VAN	Voltage A phase to N	Integer/Real
_VBN	Voltage B phase to N	Integer/Real
_VCN	Voltage C phase to N	Integer/Real
_VAB	Voltage A phase to B phase	Integer/Real
_VBC	Voltage B phase to C phase	Integer/Real
_VCA	Voltage C phase to A phase	Integer/Real
_IA	Current A Phase	Integer/Real
_IB	Current B Phase	Integer/Real
_IC	Current C Phase	Integer/Real
_HZ	Frequency	Integer/Real
_kW	Kilowatts	Integer/Real
_kVA	kVA	Integer/Real
_kWhr	Power usage	Integer/Real
_PW	Power	Bit
_GEN	Generator	Bit
_SBY	Standby	Bit

5.5.5 ALARMS (Tag Suffix)

ALARMS		
_ALM1	General Alarm	Bit
_AALM1	Analog Bad Raw Data	Bit
_KALM1	Contactor coil Fail Alarm	Bit
_HHALM1	High Alarm	Bit
_HALM1	High Alarm	Bit
_LALM1	Low Alarm	Bit
_LLAM1	Low Alarm	Bit
_DVALM1	Deviation Alarm	Bit
_DVLALM1	Deviation Low Alarm	Bit
_DVHALM1	Deviation High Alarm	Bit

Alarm Setpoints		
_HHTRIP1C	High Alarm Trip Point	Integer/Real
_HTRIP1C	High Alarm Trip Point	Integer/Real
_LTRIP1C	Low Alarm Trip Point	Integer/Real
_LLTRIP1C	Low Alarm Trip Point	Integer/Real
_DTRIP1C	Deviation trip Point	Integer/Real
_LDTRIP1C	Low Deviation Trip Point	Integer/Real
_HDTRIP1C	High Deviation Trip Point	Integer/Real
_AHYST1C	Alarm Hysteresis	Integer/Real
_HHHYST1C	High Alarm Hysteresis	Integer/Real
_HHYST1C	High Alarm Hysteresis	Integer/Real
_LHYST1C	Low Alarm Hysteresis	Integer/Real
_LLHYST1C	Low Alarm Hysteresis	Integer/Real
_LDHYST1C	Low Deviation Alarm Hysteresis	Integer/Real

_HDHYST1C	High Deviation Hysteresis	Integer/Real

5.5.6 EQUIPMENT CONTROL (Tag Suffix)

Equipment Control		
_ARR	Auto Run Relay	Bit
_AUT	Auto	Bit
_CB	Circuit Breaker	Bit
_ENA	Enabled	Bit
_EST	Emergency Stop	Bit
_FCL	Fail to Close	Bit
_FLD	Field Isolator	Bit
_FLT	General Fault	Bit
_FOP	Fail to Open	Bit
_FSP	Fail to Stop	Bit
_FST	Fail to Start	Bit
_ILK	Interlock	Bit
_ISO	Isolator	Bit
_K	Contactor	Bit
_MAN	Manual	Bit
_NF	No Flow	Bit
_OL	Overload	Bit
_OT	Over Temperature	Bit
_PipeBlk	Pipe Blocked	Bit
_SEQ	Sequence Control	Bit
_SF	Seal Fail	Bit
_SPD	Speed	Bit
_TRIP	Trip	Bit
_TRQ	Torque	Bit
_DSPD	Drive Speed	Integer/Real
_SPD	Speed	Integer/Real
_SPD2	Fixed Speed SP	Integer/Real
_SPD3	CTL Speed SP	Integer/Real

5.5.7 GENERAL CONTROL (Tag Suffix)

General Control		
_DLY	Timer Delay	Integer
_TIM	Timer Delay	Integer
_CNT	Counter	Integer
_PB	Push Button	Bit
_STRT	Start	Bit
_STOP	Stop	Bit
_RST	Reset	Bit
_UP	Raise	Bit
_DN	Lower	Bit
_LEV	Level	Bit
_H	High	Bit
_HH	High	Bit
_L	Low	Bit
_LL	Low	Bit

_AVL	Available	Bit
_RDY	Ready	Bit
_OPN	Open	Bit
_CLS	Close	Bit
_OPND	Open	Bit
_CLSD	Close	Bit
_TEMP	Temperature	Integer
_PRES	Pressure	Bit
_TEST	Test	Bit
_OSR	One Shot Rising edge	Bit
_OSF	One Shot Trailing edge	Bit
_NPA	No Duty Pump Available	Bit
_ENA	Enabled	Bit
_ARQ	Auto Run Request	Bit
_ORQ	Open Request	Bit
_MODE	Control Mode	Integer

ACCUMULATORS (Tag Suffix)

Accumulators		
_ST1Q	Total starts Accumulator	REAL
_ST2Q	Daily starts Accumulator	REAL
_ST3Q	Previous Daily starts Accumulator	REAL
_ST4Q	Weekly starts Accumulator	REAL
_ST5Q	Weekly Daily starts Accumulator	REAL
_HR1Q	Total Hours Accumulator	REAL
_HR2Q	Daily Hours Accumulator	REAL
_HR3Q	Previous Daily Hours Accumulator	REAL
_HR4Q	Weekly Hours Accumulator	REAL
_HR5Q	Weekly Daily Hours Accumulator	REAL
_F1Q	Total Flow Accumulator	REAL
_F2Q	Daily Flow Accumulator	REAL
_F3Q	Previous Daily Flow Accumulator	REAL
_F4Q	Weekly Flow Accumulator	REAL
_F5Q	Previous Weekly Flow Accumulator	REAL
_RS1QC	Request Accumulator 1 Reset	Bit
_RS1MC	Request Maintenance Hrs Reset	Bit

6 STANDARD DEVICE MODELS

Standard device models will be used to ensure compliance between PLC and SCADA Pop-ups.
These device models are subject to change it is the contractor's responsibility to obtain the latest device models from the principle prior to commencing programming.

6.1 STD VSD DRIVE MODEL

FB I/O					
_Function Block I/O					
Description	**Type**	**Tag**	**Data**	**Address**	
AUTO mode Run Request	Input	_ARQ	Digital	cioxx	
Phase Fail Relay Input	Input	_PFR	Digital	cioxx	
AUTO Selected	Input	_AUT	Digital	cioxx	
Field Isolator On	Input	_FLD	Digital	cioxx	
Ready Relay input from MCC.	Input	_RDY	Digital	cioxx.xx	
Motor Running Feedback	Input	_K	Digital	cioxx.xx	
Seal Failure Trip	Input	_SF	Digital	cioxx.xx	
Motor Over torque Switch or Electronic Shear pin	Input	_TRQ	Digital	cioxx.xx	
Motor Thermistor Over temperature Trip	Input	_OT	Digital	cioxx.xx	
Thermal Overload Fault	Input	_OL	Digital	cioxx.xx	
Run Permissive Interlocks Healthy	Input	_ILK	Digital	cioxx.xx	
Selected for Duty	Input	_DTY	Digital	cioxx.xx	
Flow Established	Input	_FLOW	Digital	cioxx.xx	
No Flow Trip Delay Set point (1 = 0.1s)	Input	_TNF	Integer	Dxxx	
VSD Auto Run Set point (0-100%)	Input	-VSD_AUTO_SP	Integer	DMxx	
VSD Remote Manual Set point	Input	-RSPD1C	Integer	DMxx	
Auto Run Control Relay	Output	-ARR	Digital	cioxx.xx	
Reset Relay	Output	_RS3C	Digital	cioxx.xx	

Equipment Log			
Equipment Data 20 Words			
Description	**Tag**	**Data**	**Address**
Total Starts	xxx_ST1Q	REAL	DMxx
Total Hours	xxx_HR1Q	REAL	DMxx+2

Status Word		
_STA Digital 1 Word cioxx		
Description	**Tag**	**Address**
Auto Selected	xxx_AUT1	cioxx Bit 00
Remote Manual Selected	xxx_REM1	cioxx Bit 01
Manual Selected	xxx_MAN1	cioxx Bit 02
Ready in Auto	xxx_RDY1	cioxx Bit 03
Running	xxx_RUN1	cioxx Bit 04
Out of Service	xxx_OS1	cioxx Bit 05
Maintenance Due	xxx_MAINT1	cioxx Bit 06
General Fault	xxx_FLT1	cioxx Bit 07
Running Reverse	xxx_REV1	cioxx Bit 08
Reserved		cioxx Bit 09
Reserved		cioxx Bit 10
Reserved		cioxx Bit 11
Reserved		cioxx Bit 12
Critical Fault	xxx_FLT3	cioxx Bit 13
Duty Selected	xxx_DTY	cioxx Bit 14
Process Interlock	xxx_ILK1	cioxx Bit 15
Safety interlocks still in circuit in Remote Manual Mode		

Control Word		
_CTL Digital 1 Word cioxx+1		
Description	**Tag**	**Address**
Auto Mode Request	xxx_AUT1C	cioxx (+1) Bit 00
Remote Manual Mode Request	xxx_REM1C	cioxx (+1) Bit 01
Remote Manual Start Request	xxx_RMST1C	cioxx (+1) Bit 02
Remote Manual Stop Request	xxx_RMSP1C	cioxx (+1) Bit 03
Alarm Reset Request	xxx_RS1C	cioxx (+1) Bit 04
Maintenance Hrs Reset Request	xxx_RS1MC	cioxx (+1) Bit 05
Total Acc Reset Request	xxx_RS1QC	cioxx (+1) Bit 06
Out of Service Request	xxx_OS1C	cioxx (+1) Bit 07
Out of Service Reset Request	xxx_RS1OSC	cioxx (+1) Bit 08
Reverse Mode Request	xxx_REV1C	cioxx (+1) Bit 09
Reserved		cioxx (+1) Bit 10
Reserved		cioxx (+1) Bit 11
Reserved		cioxx (+1) Bit 12
Reserved		cioxx (+1) Bit 13
Reserved		cioxx (+1) Bit 14
Reserved		cioxx (+1) Bit 15

Alarm Word		
_ALM Digital 1 Word cioxx + 2	**Column1**	**Column2**
Description	**Tag**	**Address**
Main CB Off	xxx_MCB1	cioxx (+2) Bit 00
Control CB Off	xxx_CCB1	cioxx (+2) Bit 01
Field Isolator on	xxx_FLD1	cioxx (+2) Bit 02
Overload Trip	xxx_OL1	cioxx (+2) Bit 03
Seal Fail	xxx_SF1	cioxx (+2) Bit 04
Over Torque	xxx_TRQ1	cioxx (+2) Bit 05
No Flow	xxx_NF1	cioxx (+2) Bit 06
Over Temp	xxx_OT1	cioxx (+2) Bit 07
VSD Over Temp	xxx_OT2	cioxx (+2) Bit 08
Drive Fault	xxx_FLT2	cioxx (+2) Bit 09
Comms Fail	xxx_CF1	cioxx (+2) Bit 10
Critical Fault	xxx_FLT3	cioxx (+2) Bit 11
Reserved		cioxx (+2) Bit 12
Reserved		cioxx (+2) Bit 13
Fail to stop	xxx_FSP1	cioxx (+2) Bit 14
Fail to start	xxx_FST1	cioxx (+2) Bit 15

Ethernet Data		
Data 20 Words (+ 20 CIO words for Ethernet CTL and STATUS.)		
Description	**Tag**	**Address**
Drive Ethernet Write Word No.1 (Command)	xxx_EthW_CMD	cioxx
Drive Ethernet Write Word No.2 (Speed Ref)	xxx_EthW_SPDC	cioxx +1
Drive Ethernet Write Word No.3 (Reserved)	xxx_EthW_SP1	cioxx +2
Drive Ethernet Write Word No.4 (Reserved)	xxx_EthW_SP2	cioxx +3
Drive Ethernet Write Word No.5 (Reserved)	xxx_EthW_SP3	cioxx +4
Drive Ethernet Write Word No.6 (Reserved)	xxx_EthW_SP4	cioxx +5
Drive Ethernet Write Word No.7 (Reserved)	xxx_EthW_SP5	cioxx +6
Drive Ethernet Write Word No.8 (Reserved)	xxx_EthW_SP6	cioxx +7
Drive Ethernet Write Word No.9 (Reserved)	xxx_EthW_SP7	cioxx +8
Drive Ethernet Write Word No.10 (Reserved)	xxx_EthW_SP8	cioxx +9
Drive Ethernet Read Word No.1 (Status)	xxx_EthR_STA	cioxx +10
Drive Ethernet Read Word No.2 (Error)	xxx_EthR_ERR	cioxx +11
Drive Ethernet Read Word No.3 (Output Frequency)	xxx_EthR_FREQ	cioxx +12
Drive Ethernet Read Word No.4 (Torque)	xxx_EthR_TRQ	cioxx +13
Drive Ethernet Read Word No.5 (Current)	xxx_EthR_I	cioxx +14
Drive Ethernet Read Word No.6 (Voltage)	xxx_EthR_V	cioxx +15
Drive Ethernet Read Word No.7 (Power)	xxx_EthR_PW	cioxx +16
Drive Ethernet Read Word No.8 (Drive Thermal)	xxx_EthR_DTH	cioxx +17
Drive Ethernet Read Word No.9 (Motor Thermal)	xxx_EthR_MTH	cioxx +18
Drive Ethernet Read Word No.10 (Reserved)	xxx_EthR_SP1	cioxx +19

6.2   STANDARD FIXED SPEED DRIVE MODEL

_Function Block Inputs			
Description	**Tag**	**Data**	**Address**
AUTO mode Run Request	_ARQ	Digital	cioxx
Phase Fail Relay Input	_PFR	Digital	cioxx
AUTO Selected	_AUT	Digital	cioxx
Field Isolator On	_FLD	Digital	cioxx
Ready Relay input from MCC.	_RDY	Digital	cioxx
Motor Running Feedback	_K	Digital	cioxx
Seal Failure Trip	_SF	Digital	cioxx
Motor Over torque Switch or Electronic Shear pin	_TRQ	Digital	cioxx
Motor Thermistor Over temperature Trip	_OT	Digital	cioxx
Thermal Overload Fault	_OL	Digital	cioxx
Run Permissive Interlocks Healthy	_ILK	Digital	cioxx
Selected for Duty	_DTY	Digital	cioxx
Flow Established	_FLOW	Digital	cioxx
No Flow Trip Delay Set point (1 = 0.1s)	_TNF	Integer	Dxxx
Maintenance Hours Set point (from SCADA) (1=0.1hrs)	_M_HR1Q_SP	REAL	Dxxx
Maintenance Hours	_M_HR1Q	Integer	DMxx
Auto Run Control Relay	ARR	Digital	cioxx

Status Word		
_STA Digital 1 Word cioxx		
Description	**Tag**	**Address**
Auto Selected	xxx_AUT1	cioxx Bit 00
Remote Manual Selected	xxx_REM1	cioxx Bit 01
Manual Selected	xxx_MAN1	cioxx Bit 02
Ready in Auto	xxx_RDY1	cioxx Bit 03
Running	xxx_RUN1	cioxx Bit 04
Out of Service	xxx_OS1	cioxx Bit 05
Maintenance Due	xxx_MAINT1	cioxx Bit 06
General Fault	xxx_FLT1	cioxx Bit 07
Reserved		cioxx Bit 08
Reserved		cioxx Bit 09
Reserved		cioxx Bit 10
Reserved		cioxx Bit 11
Reserved		cioxx Bit 12
Critical Fault	xxx_FLT3	cioxx Bit 13
Process Interlock	xxx_DTY1	cioxx Bit 14
Process Interlock	xxx_ILK1	cioxx Bit 15
Safety interlocks still in circuit in Remote Manual Mode		

Control Word		
_CTL Digital 1 Word cioxx+1		
Description	**Tag**	**Address**
Auto Mode Request	xxx_AUT1C	cioxx (+1) Bit 00
Remote Manual Mode Request	xxx_REM1C	cioxx (+1) Bit 01
Remote Manual Start Request	xxx_RMST1C	cioxx (+1) Bit 02
Remote Manual Stop Request	xxx_RMSP1C	cioxx (+1) Bit 03
Alarm Reset Request	xxx_RS1C	cioxx (+1) Bit 04
Maintenance Hrs Reset Request	xxx_RS1MC	cioxx (+1) Bit 05
Total Acc Reset Request	xxx_RS1QC	cioxx (+1) Bit 06
Out of Service Request	xxx_OS1C	cioxx (+1) Bit 07
Out of Service Reset Request	xxx_RS1OSC	cioxx (+1) Bit 08
Reserved		cioxx (+1) Bit 09
Reserved		cioxx (+1) Bit 10
Reserved		cioxx (+1) Bit 11
Reserved		cioxx (+1) Bit 12
Reserved		cioxx (+1) Bit 13

Alarm Word		
_ALM Digital 1 Word cioxx+2		
Description	**Tag**	**Address**
Reserved		cioxx (+2) Bit 00
Reserved		cioxx (+2) Bit 01
Field Isolator on	xxx_FLD1	cioxx (+2) Bit 02
Overload Trip	xxx_OL1	cioxx (+2) Bit 03
Seal Fail	xxx_SF1	cioxx (+2) Bit 04
Over Torque	xxx_TRQ1	cioxx (+2) Bit 05
No Flow	xxx_NF1	cioxx (+2) Bit 06
Reserved		cioxx (+2) Bit 07
Reserved		cioxx (+2) Bit 08
Over Temp	xxx_OT1	cioxx (+2) Bit 09
Reserved		cioxx (+2) Bit 10
Reserved		cioxx (+2) Bit 11
Reserved		cioxx (+2) Bit 12
Reserved		cioxx (+2) Bit 13
Fail to start	xxx_FST1	cioxx (+2) Bit 14
Fail to stop	xxx_FSP1	cioxx (+2) Bit 15

Equipment Log			
Equipment Data 22 Words			
Description	**Tag**	**Data**	**Address**
Total Starts	xxx_ST1Q	REAL	DMxx
Total Hours	xxx_HR1Q	REAL	DMxx+2
kW	xxx_kW	REAL	DMxx+4
kWhr	xxx_kWhr	REAL	DMxx+6
Motor Amps	xxx_Amps	REAL	DMxx+8
Motor Power Factor	xxx_pF	REAL	DMxx+10

6.3   STANDARD INSTRUMENT DEVICE MODEL

FB I/O			
_Function Block Inputs			
Description	**Tag**	**Data**	**Address**
Raw Data Offset	_Offset	INT	Dxxx
Raw Analog Signal	_RawSig	INT	cioxx
Minimum scaled value	_Min_EU	REAL	Dxxx
Maximum scaled value	_Max_EU	REAL	Dxxx
Fault Mode\n0=Min\n1=Max\n2=Last Good	_Flt_Mode	INT	Dxxx
Alarm Damping Delay Set point (1 = 0.1sec)	_AALM_SP	INT	Dxxx
HOLD Mode Time Set point (from SC ADA) (Minutes)	_HLDSP1C	INT	Dxxx
Instrument Healthy/Fault input	_FLT	Digital	cioxx.xx
LLTrip Set point	xxx_LLTRIP1C	REAL	DMxx
L Trip Set point	xxx_LTRIP1C	REAL	DMxx
H Trip Set point	xxx_HTRIP1C	REAL	DMxx
HH Trip Set point	xxx_HHTRIP1C	REAL	DMxx
Hold Mode Duration	xxx_HLDSP1C	REAL	DMxx
Flow log Increment constant (Flow meters only)	_INC_FQ	REAL	Dxxx

Status Word		
_STA Digital 1 Word cioxx		
Description	**Tag**	**Address**
Out of Service	xxx_OS1	cioxx Bit 00
General Faulty	xxx_FLT1	cioxx Bit 01
Analog Instrument Fault	xxx_ALM1	cioxx Bit 02
Analog Alarm Bad Raw Data	xxx_AALM1	cioxx Bit 03
LL Alarm	xxx_LLALM1	cioxx Bit 04
L Alarm	xxx_LALM1	cioxx Bit 05
H Alarm	xxx_HALM1	cioxx Bit 06
HH Alarm	xxx_HHALM1	cioxx Bit 07

HH Alarm	xxx_HLD1	cioxx Bit 08
Reserved	Reserved	cioxx Bit 09
HH Alarm	xxx_RS1C	cioxx Bit 10
HH Alarm	xxx_OS1C	cioxx Bit 11
HH Alarm	xxx_RS1OSC	cioxx Bit 12
HH Alarm	xxx_HLD1C	cioxx Bit 13
HH Alarm	xxx_RSHLD1C	cioxx Bit 14
Reserved	Reserved	cioxx Bit 15

Misc			
Data 14 Words			
Description	**Tag**	**Data**	**Address**
Process Variable	xxx_PV	Integer	DMxx
Process Variable	xxx_PV_R	REAL	DMxx+1
Total Flow (For Flow meters only)	xxx_F1Q	REAL	DMxx+5

6.4   STD PID LOOP CONTROLLER MODEL

FB I/O			
_Function Block Inputs			
Description	**Tag**	**Data**	**Address**
Proportional Gain SP	LPxxx_P1C	INT	DMxx
Integral Time SP	LPxxx_TI1C	INT	DMxx
Differential Time SP	LPxxx_TD1C	INT	DMxx
Maximum MV loop output	LPxxx_YMAX1C	INT	DMxx
Minimum MV loop output	LPxxx_YMIN1C	INT	DMxx
MV Output Man SP	LPxxx_YMAN1C	INT	DMxx
Deviation Alarm SP	LPxxx_DVTRIP1C	INT	DMxx
Sample Time	LPxxx_ST1C	INT	DMxx
LP Auto mode Request	LPxxx_AUT1C	Digital	cioxx.xx
LP Manual mode Request	LPxxx_MAN1C	Digital	cioxx.xx
LP Reverse select	LPxxx_REV1C	Digital	cioxx.xx
Enable PID Processing	LPxxx_PID_ENA	Digital	cioxx.xx

Status Word		
_STA Digital 1 Word cioxx		
Description	**Tag**	**Address**
LP Output Mode is Auto	LPxxx_AUT1	cioxx Bit 00
LP Output Mode is Manual	LPxxx_MAN1	cioxx Bit 01
Deviation Alarm	LPxxx_DVALM1	cioxx Bit 02

Misc		
Data 12 Words	**Column1**	**Column2**
Description	**Tag**	**Address**
Set point	LPxxx_SP1	DMxx
Process Variable	LPxxx_PV1	DMxx+1
MV Loop Output	LPxxx_MV1	DMxx+2

6.5 STD DUTY CONTROL MODEL

FB I/O			
_Function Block Inputs			
Description	**Tag**	**Data**	**Address**
Unit 1 Available	xxx1_AVAIL	Digital	cioxx.xx
Unit 2 Available	xxx2_AVAIL	Digital	cioxx.xx
Unit 1 Running	xxx1_RUN1	Digital	cioxx.xx
Unit 2 Running	xxx2_RUN1	Digital	cioxx.xx

Status Word		
_STA Digital 1 Word cioxx		
Description	**Tag**	**Address**
Duty Alternate Mode Request	xxx_DTY1C	cioxx Bit 00
Duty Fixed Mode Request	xxx_DTY2C	cioxx Bit 01
Duty Set No Pumps Available	xxx_NPA1	cioxx Bit 02

Misc		
Data 3 Words		
Description	**Tag**	**Address**
Column1	**Column2**	**Column3**
Maximum Run Time	xxx_MRT1	DMxx
Maximum Run Time Set point	xxx_MRTSP1C	DMxx+1
Maximum Run Time EV	xxx_MRT_EV1	DMxx+2

6.6   STD VALVE MODEL

I/O			
_Function Block Inputs			
Description	**Tag**	**Data**	**Address**
Maintenance operations SP	xxx_M_ST1Q_SP	REAL	DMxx
Valve Fully Opened	xxx_OPN	Digital	cioxx.xx
Valve Fully Closed	xxx_CLS	Digital	cioxx.xx
Run Permissive Interlocks Healthy	xxx_ILK	Digital	cioxx.xx
AUTO mode Open Request	xxx_ORQ	Digital	cioxx.xx
Failed to Open/Close Timer Delay Set point (1 = 0.1s)	xxx_T_SP	INT	DMxx
Rem Man Position SP (Actuated Valves Only)	xxx_RPOS1C	INT	DMxx
Actual Position Ref (Actuated Valves Only)	xxx_POS1	INT	DMxx
Open Control Relay	xxx_OCR	Digital	cioxx.xx

Status Word		
_STA Digital 1 Word cioxx		
Description	**Tag**	**Address**
Auto Selected	xxx_AUT1	cioxx Bit 00
Remote Manual Selected	xxx_REM1	cioxx Bit 01
Ready in Auto	xxx_RDY1	cioxx Bit 02
Valve is Open	xxx_OPN1	cioxx Bit 03
Valve is Closed	xxx_CLS1	cioxx Bit 04
Out of Service	xxx_OS1	cioxx Bit 05
General Fault	xxx_FLT1	cioxx Bit 07
Process Interlock	xxx_ILK1	cioxx Bit 08
Reserved		cioxx Bit 09
Reserved		cioxx Bit 10
Reserved		cioxx Bit 11
Reserved		cioxx Bit 12
Reserved		cioxx Bit 13
Reserved		cioxx Bit 14
Reserved		cioxx Bit 15

Control Word		
_CTL Digital 1 Word cioxx+1		
Description	**Tag**	**Address**
Auto Mode Request	xxx_AUT1C	cioxx (+1) Bit 00
Remote Manual Mode Request	xxx_REM1C	cioxx (+1) Bit 01
Remote Manual Open Request	xxx_RMOP1C	cioxx (+1) Bit 02
Remote Manual Close Request	xxx_RMCL1C	cioxx (+1) Bit 03

Out of Service Reset Request	xxx_RS1OSC	cioxx (+1) Bit 05
Out of Service Request	xxx_OS1C	cioxx (+1) Bit 06
Total Acc Reset Request	xxx_RS1QC	cioxx (+1) Bit 07
Alarm Reset Request	xxx_RS1C	cioxx (+1) Bit 08
Reserved		cioxx (+1) Bit 09
Reserved		cioxx (+1) Bit 10
Reserved		cioxx (+1) Bit 11
Reserved		cioxx (+1) Bit 12
Reserved		cioxx (+1) Bit 13
Reserved		cioxx (+1) Bit 14
Reserved		cioxx (+1) Bit 15

Misc			
Data 6 Words			
Description	**Tag**	**Data**	**Address**
Total Starts	xxx_ST1Q	REAL	DMxx

7 COMMUNICATIONS.

7.1 PLC Peer to Peer Communications

All peer to peer communications between individual processors shall be conducted utilising EIP Ethernet communications cards. Messaging control and routing will be achieved using Omron CX-Network Configuration software.

7.2 PLC - VSD Communications

All Drives with communications options will utilise EIP cards and Ethernet protocol.

7.3 Third Party Communications protocols

Where protocols other than Ethernet must be used A Red Lion Data Station Plus protocol converter will be incorporated to map and manage data.

8 Preferred Equipment

Preferred Equipment of PLC/SCADA/HMI shall comply with EL03 - Preferred Electrical and Instrument Equipment and standards called upon in EL01to EL22.