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OASYS PCS SCADA / RTU Communication Plan

E354086-00000-271-078-0012

REV. 03

DOCUMENT APPROVAL PROCESS

NAME		POSITION/MEETING NO.	SIGNATURE	DATE
Originators:	Hugo Rust	SCADA Software Engineer		30-10-2018
	Nitin Vithal	PLC Lead Engineer		30-10-2018
Approver:	Paulo De Sousa Gomes	Project Manager		23-12-2019
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DOCUMENT CHANGE HISTORY:

The owner of this document is responsible for the revision and control of the document, including updating of the table below, which contains the history of the document with details of each revision.			
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This table summarises what has been changed in the document so that it is easy to keep track of the effected changes.


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1 INTRODUCTION

1.1 Purpose

The purpose of this document is to control and document the interface between the OASys PCS SCADA systems installed at the MCC and local stations, and the PLC / Flow Computer systems installed at the local stations.

1.2 Scope

1.2.1 Requirements Included

This document includes control system device\instrument specifications relating to,

- The hardware interface between the SCADA and PLC/Flow Computers.
- The protocol which will be used
- The data types which will be used
- The polling frequency and philosophy behind it
- The packing of data and the structures behind it
- Format of the values (EU vs RAW)
- Quality Management
- SCADA communication alarming and faceplate

1.2.2 Requirements Excluded

This document does not deal with,

- Device specific communication requirements
- Specific control system implementation requirements.

1.3 Terms and Definitions

Alarm Blocking	An alarm is blocked when both the message and the trigger condition are not activated, and no visible alarm or action occurs. Alarm handling location to be determined (FC/PLC/SCADA)
Alarm Suppression	An alarm is suppressed when only the alarm message is not activated but the trigger condition is still evaluated. The intent is to reduce standing alarms. Alarm handling location to be determined (FC/PLC/SCADA)
MCC	The term MCC is used to indicate the central control function. Note that MCC refers to the function not the location. The location of the MCC may move depending on operational needs.

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PCS The Process Control System (PCS) refers to the complete control system required for the operation of the TPL sites from the field interface to the operator interface.

Site The term site is used to indicate the local station.

1.3.1 Abbreviations

ACDB	Alarm Configuration Database
AIM	Analogue Input Monitoring
API	American Petroleum Institute
AS	PL723 Automation Standard
ASCII	American Standard Code for Information Interchange
CCOTF	Change of Configuration On The Fly
CO	Co-ordinating Officer
CV	Control Valve
DCS	Distributed Control System
DDT	Derived Data Type
DDDT	Device Derived Data Type
DDF	Detected Dangerous Failure
DDS	Detailed Design Specification
DIE	Diesel
DO	Digital Output
DOL	Direct Online
DTM	Device Type Manager
ECP	Effluent Control Panel
EDS	Engineering Design Specification
EDT	Elementary Data Type
EFB	Elementary Function Block
ePAC	Ethernet Programmable Automation Controller
ES	Engineering System
EU	Engineering Units
F&G	Fire and Gas
FC	Flow Computer
FDS	Functional Design Specification
FDT	Field Device Type
FFB	Collective term for EF, EFB and DFB
FRS	Functional Requirements Specification

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GPL	General Purpose Library
HART	Highway Addressable Remote Transducer
HMI	Human Machine Interface
HSBY	Hot Standby
I/O	Input/output
IODDT	I/O Derived Data Type
IP	Industrial Protocol
IS	Intrinsically Safe
LAN	Local Area Network
LV	Low Voltage
MCC	Master Control Centre
MDS	Metering System
MIS	Manufacturing Information System
MMS	Machine Monitoring System
MoC	Mode of Control
MoO	Mode of Operation
MTBF	Mean Time Between Failure
MTTR	Mean Time To Replacement
MV	Medium Voltage
NOC	National Operations Centre
OPC	OLE for Process Control
OS	Operating System
P&ID	Piping and Instrumentation Drawing
PCS	Process Control System
PDU	Protocol Data Unit
PFD	Process Flow Diagram
PID	Proportional, Integral & Derivative Controller
PLC	Programmable Logic Controller
PLC	Programmable Logic Controller
RIO	Remote Input/Outputs
RTU	Remote Terminal Unit
SCADA	Supervisory, Control and Data Acquisition
SCC	Secondary Control Centre
SIF	Safety Instrumented Function
SIL	Safety Integrity Level

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SIS	Safety Instrumented System
SNMP	Simple Network Management Protocol
SO	Station Operator
TBA	To be Advised
TBC	To be Confirmed
TBD	To be Defined
TCP	Transmission Control Protocol
TGS	Tank Gauging System
URS	User Requirements Specification (Control Philosophy)
VSD	Variable Speed Drive
WAN	Wide Area Network

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2 APPLICABLE DOCUMENTS

All documents of the exact revision cited in the Applicable Documents form part of this specification to the extent specified.

However, nothing in this specification supersedes applicable laws and regulations.

2.1 TPL Applicable Specifications and Standards

No. and Title	Doc. No.	Rev.
[1] SCADA Functional Design Specification	E354086-00000-271-078-0018	Latest Revision
[2] PLC Functional Design Specification	E354086-00000-271-078-0003	Latest Revision
[3] PCS Control Module Specification	E354086-00000-271-078-0005	Latest Revision
[4] LDS Functional Design Specification	E354086-00000-271-078-0007	Latest Revision
[5] Metering Functional Design Specification	E354086-00000-271-078-0020	Latest
[6] LAN Network Standard	E354086-00000-271-078-0002	Latest Revision
[7] PCS SCADA System Architecture	E354086-00000-271-256-0002	Latest Revision
[8] PLC LAN Architecture Typical Pump Station	E354086-00000-271-256-0006	Latest Revision
[9] PLC LAN Architecture Typical Booster Station	E354086-00000-271-256-0005	Latest Revision
[10] PLC LAN Architecture Fynnlands Intake Station	E354086-00001-271-256-0001	Latest Revision
[11] PLC LAN Architecture Coalbrook	E354086-00017-271-256-0001	Latest Revision
[12] PCS System Performance Specification	E354086-00000-271-078-0014	Latest Revision

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[13]	Software Configuration Management Plan	E354086-00000-271-050-0002	Latest Revision
[14]	Software Lifecycle Plan	E354086-00000-130-050-0001	Latest Revision
[15]	ICD: TPL WAN – Crude Oil Pipeline Automation System LANs	H354086-00000-276-242-0001	0
[16]	Tele-control Communication Standard	PL703	1.0
[17]	Automation Standard	PL723	04

2.2 Other Applicable Specifications and Standards

The following national and international standards are required to be complied with and shall be read in conjunction with this Specification.

No. and Title	Doc. No.	Rev.
[18] Quality Management Systems	SABS ISO 9000	2015

2.3 Reference Documentation

The documents included in this section do not form part of the specification, but are included for background and context.

No.	Doc. No.	Rev.
[19] Modbus Messaging on TCP/IP Implementation Guide		1.0b
[20] PLC System Architecture Failure and Recovery Design	E354086-00000-271-078-0016	Latest
[21] OASyS DNA Controller Guide	7.6R3	Dec 17
[22] SCADA System Architecture Failure and Recovery Design	E354086-00000-271-078-0013	Latest
[23] Modicon M580 BMENOC0321 Control Network Module Installation and Configuration Guide	NVE24232.02	09/2017
[24] SCADA Pipeline Edition Control Room Management (CRM) Administrator Guide		June 2018
[25] PCS Performance Test Criteria Document	E354086-00000-271-066-0001	Latest

2.4 Reference Websites


The following is citations used in this document from the internet.

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Description	Author.	URL
[26] Modbus Specification	Modbus Organization	http://www.modbus.org/specs.php

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3 SYSTEM ARCHITECTURE

3.1 PLC System Architecture

Refer to the PLC System Architectures [8], [9], [10] and [11].

3.2 SCADA System Architecture

Refer to the SCADA System Architecture [7].

3.3 LAN Specification

The Ethernet LAN layout is configured as per the LAN Network Standard [6].

3.4 SCADA-RTU Comms Philosophy

- Redundant communications are provided between the SCADA system (Local and MCC) and the PLC/FC systems installed on a station.
- Realtime data is transferred between the PLC/FCs installed on a station and the local SCADA Realtime database using the X-Modbus protocol via a polling mechanism.
- Realtime data is transferred between the Local SCADA and MCC SCADA Realtime databases using a proprietary OASyS database replication mechanism.
- During abnormal operating conditions (when the local SCADA is not available), real-time data is transferred between the PLC/FCs installed on a station and the MCC SCADA Realtime database using the X-Modbus protocol via a polling mechanism. This fall-back position is manually activated.

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4 MODBUS PROTOCOL

4.1 Description

Modbus is an application-layer (Layer 7) messaging protocol of the OSI model. It provides client/server communication between devices connected on different types of buses or networks [26]. Modbus TCP is implemented on the PCS Upgrade Project.

Modbus is a request/reply protocol and offers services specified by function codes. Modbus function codes are elements of Modbus request/reply PDUs [26].

Please refer to the Modbus Messaging on TCP/IP Implementation Guide [19] for a detailed description of the protocol.

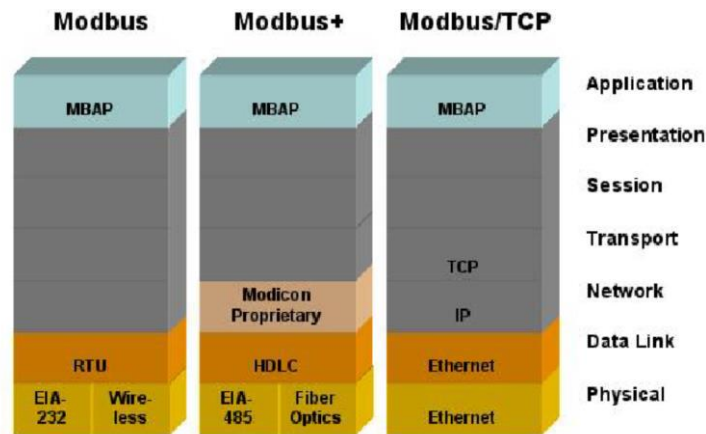


Table 4-1: Modbus TCP Stack Comparison

4.1.1 Modbus Function Codes

Function type			Function name	Function code
Data Access	Bit access	Physical Discrete Inputs	Read Discrete Inputs	2
		Internal Bits or Physical Coils	Read Coils	1
			Write Single Coil	5
			Write Multiple Coils	15
	16-bit access	Physical Input Registers	Read Input Registers	4
		Internal Registers or Physical Output Registers	Read Multiple Holding Registers	3
			Write Single Holding Register	6
			Write Multiple Holding Registers	16
			Read/Write Multiple Registers	23
			Mask Write Register	22

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			Read FIFO Queue	24
	File Record Access		Read File Record	20
			Write File Record	21
Diagnostics			Read Exception Status	7
			Diagnostic	8
			Get Com Event Counter	11
			Get Com Event Log	12
			Report Slave ID	17
			Read Device Identification	43
Other			Encapsulated Interface Transport	43

Table 4-2: Modbus Function Codes

The following Function Codes (FCs) will be used in the PCS (in the event that additional Function Codes are required for communication between PLC/FC and SCADA this table can be amended):

Function name	Function code
Read Coils	1
Write Multiple Coils	15
Read Multiple Holding Registers	3
Write Multiple Holding Registers	16
Read Exception Status	7
Read Discrete Inputs	2
Read Input Registers	4
Write Single Coil	5
Write Single Holding Register	6

Table 4-3: Used Modbus Function Codes


4.2 X-Modbus

4.2.1 Description

The Extended Modbus (X-Modbus) Protocol Driver for OASyS is used to acquire Realtime process variables (FC 3) and issue setpoints (FC 6) and device commands to compatible Remote Terminal Units (RTUs) and Programmable Logic Controllers (PLCs) using the X-Modbus protocol.

The driver supports the following OASyS DNA features:

- Realtime, which includes: (to be used in this project)

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- Poll for Realtime variables – read current analog, status, rate, multistate, and rtstring points
- Writing Analog setpoint (e.g. pressure setpoint)
- Issuing Digital commands (e.g. valve control, pump or compressor control)
- Listen Only (Realtime) – listen-only processing (requires appropriate communications configuration and/or TCP listener)
- Data Download – bulk download of SCADA data and data quality information to PLCs.

4.2.2 Configuration

The following is a typical configuration of the X-Modbus connection in OASys DNA:

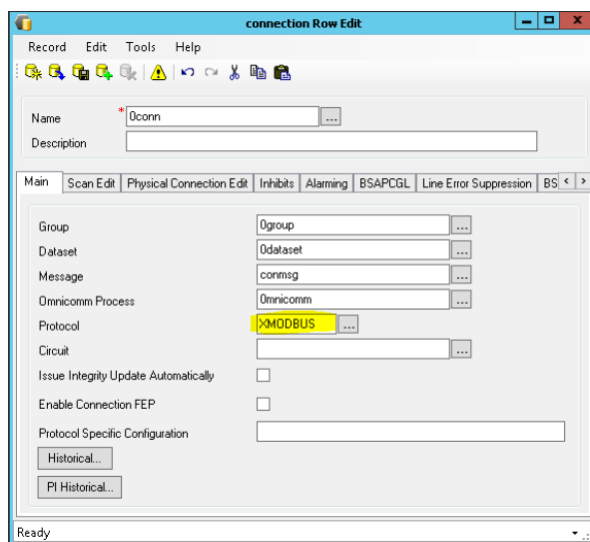



Figure 4-4: Typical X-Modbus Configuration - Connection

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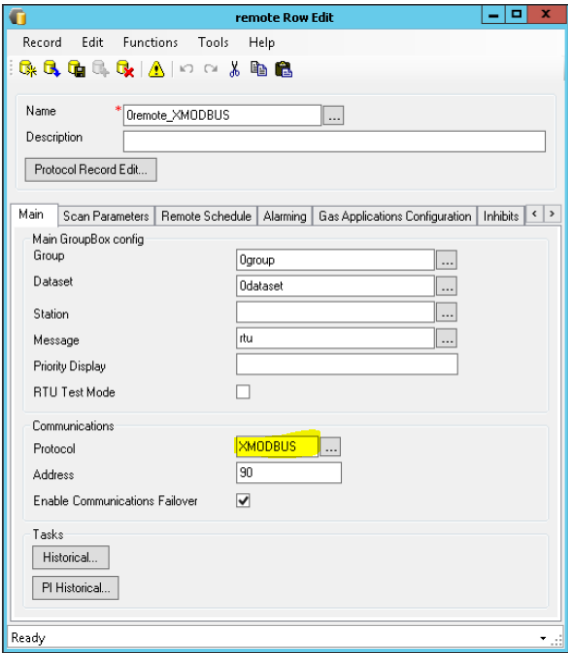


Figure 4-5: Typical X-Modbus Configuration – Remote

4.2.2.1 *Generic Protocol & Connection Configuration details (SCADA to PLC/FC)*

Protocol specific configuration (poll ranges, frequencies etc.) is detailed in section 4.3.

4.2.2.2 *Word/Byte Swap Definition*

Modbus uses 16-bit registers to hold values. 32-bit floating point numbers must therefore be split between two registers. Modbus however does not declare a standard on how to represent floating point numbers, so it is possible that different devices may handle floating point numbers differently than others. As such the SCADA driver makes it possible to perform Word/byte swaps to cater for the implementation of 32bit numbers.

For the PCS Upgrade Project, the Modicon M580 PLC/FCs, a Word Swap Definition remote configuration is set up as follows:

“SW” - swaps words (sets of pairs of bytes [CD][AB]).


Decimal	Hexadecimal Value				+/-	Exponent	Significand
	A	B	C	D			
123456.00	00	20	F1	47	0	10001111	1.1110001001000000000000

Figure 4-6: Least Significant Value First

Decimal	Hexadecimal Value				+/-	Exponent	Significand
	C	D	A	B			
+1.08658251394509650E-019	F1	47	00	20	0	01000000	1.00000000100011111110001

Figure 4-7: Most Significant Value First

Refer to OASYS DNA Administrator Guide [24] for full functionality of the X-Modbus driver.

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4.3 Polling Configuration

The following configuration for PLCs will be specifically configured for the PCS upgrade project.

Poll Number	Registers	Frequency	Minimum Poll Cycle Time (s)	Polling Frequency (s)
1	47	1	2	2
2	125	1	2	2
3	125	1	2	2
4	125	1	2	2
5	125	1	2	2
6	125	1	2	2
7	125	1	2	2

Table 4-8: Polling Configuration

4.3.1 Polling Priority

The polling engine makes provision of multiple polling rates. These rates are used to assign priority to different groups of information. Critical data is polled at a higher rate as compared to statistical data. There is an intent to use same polling priority for all poll ranges on the PCS Upgrade project. Refer to PCS Performance Test Criteria Document [25].


Note: S600 Flow Computers configuration data will be polled by manual request, therefore polling frequency for those ranges will be set as 0.

4.4 Direction and Flow of Communication

Analogue, Status, Multistate, and Rate (OASyS data types) current values are read from the PLC on polling cycles.

Setpoints/Commands are sent to the PLC/FC from faceplates (e.g. Command words, Setpoints, Parameters etc.). Setpoints/Commands interrupts the Modbus polling cycle and issues the Setpoint/Command request at the end of the current poll within a poll cycle. All Commands activate a fast poll cycle of the polling engine. This fast poll cycle continues to run for a pre-determined time (default 30 secs). Commands have a timeout in the SCADA and triggers an alarm on timeout.

4.5 M580 PLC and Modbus Mapping

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4.5.1 Modbus Memory Map

In Control Expert (Formerly Unity Pro) variables which interface with the SCADA are located at addresses. These addresses are 16bit in size and are referred to as "Marker Words"(%MW). Within the SCADA, points are created which are assigned an Input or Output Co-Ordinate. The %MW and Co-Ordinate are directly aligned as tabulated below in Figure 4-9. Bit references are also possible. Bit 0 of %MW0 will be referred to as %MW0.0. The SCADA will use Co-ordinate 0 bit 0 in this case.

PLC Address	SCADA Co-Ordinate
%MW0	0
%MW1	1
%MW2	2
%MW3	3
%MW4	4
%MW5	5

Figure 4-9: PLC address and SCADA Co-Ordinate Alignment

4.5.1.1 Standard PLC Memory Maps

Standard memory maps have been designed as in Table 4-1 **Error! Reference source not found..** A station specific memory map will be created per Site(Each PLC). This memory map forms an appendix to the Station Specific FDS document. The memory map is based on the defined size of the Control Modules developed along with the number of related IO used on that site. The aim of the memory map is to keep consistency and structure of the data within the PLC across sites. This is also to enable the SCADA to perform block read/write of contiguous registers. Device type allocations is made such that there is sufficient spare available for future addition.

Stations have an option of 3 memory map sizes : Small, Medium and Large. The sizes differ in the quantity of control modules allocated as tabulated in Table 4-1.

The Size of memory map selected is selected using the specific Site IO List to make the determination of the number of devices present.

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Site Schedule	Memory Map Proposal	Memory Map Proposal	Memory Map Proposal	Memory Map Proposal
Site Data				
Metering Manifold Configuration	Small Site	Medium Site	Large Site	TLR Dispatch
Devices				
Motors DOL 3.3kV	6	6	10	-
Motors VSD 3.3kV				
Motors DOL 400V	10	10	10	60
Valves (Actuated, ZV)	35	120	140	60
Control Valve (Actuated)	2	6	10	6
Electrical Status (devices)	20	25	30	80
Instruments (Switches)	25	55	75	100
DH Panels (DIN)	10	30	50	50
DH Panels, Siren (DOT)	10	30	50	50
Metering Interface (DIN)	10	20	30	-
Metering Interface (DOT)	40	100	100	-
Total AI Quantity	80	110	140	80
Total AO Quantity	5	10	10	10
Sequences	30	100	500	30


1. Electrical Status (device count incl breakers, transformers, gensets, batt charger)
2. Seq count based on route count x 3 (open route, start delivery, stop delivery)

Table 4-1: Station Memory Map Sizes

For Station specific PLC Data Map refer to the Site Specific PLC FDS.

4.6 S600 FC and Modbus Mapping

Data Mapping for the S600 Flow Computers will be the same across all sites. Refer to the S600 FC ICD Document **Error! Reference source not found.** for details.

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5 DATA HANDLING

5.1 Data Types

The PCS offers support of the following primary data types:

- Booleans
- Words
- Signed and Unsigned Integers
- Signed and Unsigned Double Integers
- Real/Floats (IEEE 754)
- Strings

Within the PCS Upgrade Project, a combination of following data types is used:

Boolean

The Boolean data type is a data type that has one of two possible values, intended to represent the two truth values of logic, either a On or Off (1 or 0). All status values are Boolean.

Words (Unsigned 16-bit data type)

A word is an unsigned 16-bit data type in which the 16 bits within the word are used to represent Digital Statuses or Commands. The statuses range from physical Digital IO to conditioned digital signals derived from the process application such as trip conditions or processed on/off states. Diagnostic information such as Module diagnostics and communication statues are also passed to the SCADA in Words. Boolean SCADA commands such as Open/Close and Start/Stop are passed to the PLC through Word data types.

Signed and Unsigned Integers (16-Bit)

Integer values are whole numbers that are used to represent raw analogue values from Analogue Input and Output modules.

Signed Integers have a range of -32767 to 32768

Unsigned Integers have a range of 0 to 65536


Due to the range of integer values, they are not used for calculations due to the potential of overflow.

Real / Float (IEEE 754 – 32-Bit)

Real values are 32-bit numbers which allow for decimal points. Reals are used in the PLC as scaled values and extensively used for calculations.

Signed Reals have a range of -2147483647 to 2147483647

Unsigned Reals have a range of 0 to 4294967296

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5.2 PLC Data Grouping and Structures

Bit Packing/Unpacking

All digital signals in the PCS Upgrade Project are sent to the SCADA by Bit Packing.

Bit packing is a method of optimising the efficiency at which digital (status and command) data is transferred between SCADA and PLC. The digital values from IO or status bits from the process is packed in a WORD data type by the PLC. Each bit location in a WORD represents the status of a digital bit using the BIT_TO_WORD function block. This function block is part of the Base library of Unity Pro.

The SCADA system polls Holding Registers, which are 16bit Modbus memory locations. The words received are unpacked and represent as digital statuses on the SCADA system. Each digital status is assigned a Co-ordinate (Modbus Address) and a corresponding Bit location. This function is equivalent to a WORD_TO_BIT function in the PLC.

Output functions such as Commands, are event driven by the SCADA to set bits in a command word. These specific commands are extracted and acted upon by the PLC using the WORD_TO_BIT function block.

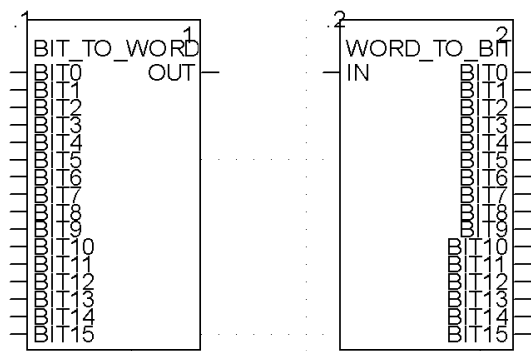


Figure 5-1: PLC BIT_TO_WORD and WORD_TO_BIT Blocks

Control Modules incorporate this method when receiving commands via Command Word and when passing status through Status Words. Refer to the PCS Control Module Specification Document [3] .

Derived Data Types

The PLC Control Modules group information into data structures called Derived Data Types (DDTs). Amongst DDTs that are used by the block for passing of data within the PLC, Derived Data Types are used to group related equipment information for the SCADA system.

All control module blocks in the PLC will typically have two SCADA related DDTs. This typically consists of a Command DDT (Used if the module receives command from the SCADA) and a SCADA Status DDT for information to be displayed on the SCADA, as shown in Figure 5-2.

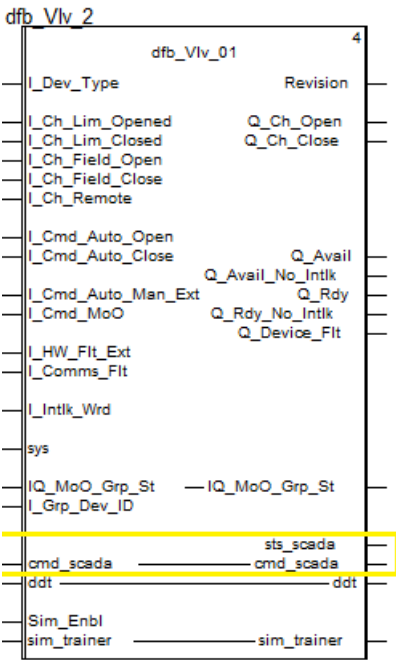



Figure 5-2: Control Block SCADA DDT

Figure 5-3: Example of a DDT Structure shows an example of a DDT structure, ddt_Vlv, which can consist of normal data types (bool, string, etc.) and other DDTs (ddt_Vlv_Par, ddt_Vlv_Ch_Hlth).

ddt_Vlv	<Struct>	Digital Valve - Device DDT
par	ddt_Vlv_Par	Parameters DDT
ch_hlth	ddt_Vlv_Ch_Hlth	Channel Health DDT
cmd	ddt_Vlv_Cmd	Command DDT
sts	ddt_Vlv_Sts	Status DDT
sim_sts	ddt_Vlv_Sim_Sts	Simulation DDT
mode	ddt_Mode	Mode DDT
Revision	STRING	Revision
Out_Open	BOOL	Open Valve Output
Out_Close	BOOL	Close Valve Output

Figure 5-3: Example of a DDT Structure

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5.3 Control Module Data Interface

5.3.1 Digital Input Monitoring

Digital Input Monitoring (DIM) and Digital Output (DO) control modules were merged to form one control module called Digital Monitoring (DM).

Refer to Section 3.5.3 on the PCS Control Module Specification [3].

5.3.2 Digital Output

Digital Input Monitoring (DIM) and Digital Output (DO) control modules were merged to form one control module called Digital Monitoring (DM).

Refer to section 3.5.3 on the PCS Control Module Specification [3].

5.3.3 Analogue Input Monitoring

Refer to section 3.5.4 on the PCS Control Module Specification [3].

5.3.4 Valves

Refer to section 3.5.5 on the PCS Control Module Specification [3].

5.3.5 Modulating Control Valves

Refer to section 3.5.6 on the PCS Control Module Specification [3].

5.3.6 LV DOL Motor

Refer to section 3.5.7 on the PCS Control Module Specification [3].

5.3.7 LV VSD Motor\Pump

Refer to section 3.5.8 on the PCS Control Module Specification [3].

5.3.8 MV DOL Mainline Motor\Pump

Refer to section 3.5.9 on the PCS Control Module Specification [3].

5.3.9 MV VSD Mainline Motor\Pump


Refer to section 3.5.10 on the PCS Control Module Specification [3].

5.3.10 LV Generator Set

Refer to section 3.5.11 on the PCS Control Module Specification [3].

5.3.11 MV Generator Set

Refer to section 3.5.12 on the PCS Control Module Specification [3].

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5.3.12 Electrical Transformer

Refer to section 3.5.13 on the PCS Control Module Specification [3].

5.3.13 Electrical Breaker

Refer to section 3.5.14 on the PCS Control Module Specification [3].

5.3.15 Electrical UPS

Refer to section 3.5.15 on the PCS Control Module Specification [3].

5.3.16 Operator Input Value

Refer to section 3.5.16 on the PCS Control Module Specification [3].

5.3.17 Sequence Controller

Refer to section 3.5.17 on the PCS Control Module Specification [3].

5.3.18 Mode of Operation

Refer to section 3.5.19 on the PCS Control Module Specification [3].

5.3.19 Duty Standby Controller

Refer to section 3.5.20 on the PCS Control Module Specification [3].

5.3.20 Duty-Speed Controller

Refer to section 3.5.21 on the PCS Control Module Specification [3].

5.3.21 Flow Compensation

Refer to section 3.5.22 on the PCS Control Module Specification [3].

5.3.22 Group Status

Refer to section 3.5.23 on the PCS Control Module Specification [3].

5.3.23 PLC Diagnostics Module

Refer to section 3.5.24 on the PCS Control Module Specification [3].

5.4 Device Group Modules Interface

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5.4.1 Rauncher

Refer to section 3.5.25 on the PCS Control Module Specification [3].

5.4.2 Dual Strainer

Refer to section 3.5.26 on the PCS Control Module Specification [3].

5.4.3 Prover

Refer to section 3.5.27 on the PCS Control Module Specification [3].

5.4.4 Stream Flow Computer

Refer to section 3.5.28 on the PCS Control Module Specification [3].

5.4.5 Prover Flow Computer

Refer to section 3.5.29 on the PCS Control Module Specification [3].


5.5 Communication Monitoring

PLC/FC communication monitoring is an OASyS DNA baseline function. Refer to OASyS DNA Controller Guide [21] for details.

Failure modes in communication are handled and described in the SCADA System Architecture Failure and Recovery Design [22] and PLC System Architecture Failure and Recovery Design [20].

Connection Summary - View Areas: P23_AUXP23_ILC/P23_MAIN/P24_AUXP24_ILC/P23_MAIN/P22_AUXP22_ILC/P22_MAIN/P21_AUXP21_ILC/P21_MAIN/P20_AUXP20_ILC/P20_MAIN/P19_AUXP19_ILC/P19_MAIN/P18_AUXP18_ILC/P18_MAIN/P17_AUXP17_ILC/P17_MAIN/P16_AUXP16_ILC/P16_MAIN/P15_AUXP15_ILC/P15_MAIN/P14_AUXP14_ILC/P14_MAIN/P13_AUXP13_ILC/P13_MAIN/P12_AUXP12_ILC/P12_MAIN/P11_AUXP11_ILC/P11_MAIN/P10_AUXP10_ILC/P10_MAIN/P09_AUXP09_ILC/P09_MAIN/P08_AUXP08_ILC/P08_MAIN/P07_AUXP07_ILC/P07_MAIN/P06_AUXP06_ILC/P06_MAIN/P05_AUXP05_ILC/P05_MAIN/P04_AUXP04_ILC/P04_MAIN/P03_AUXP03_ILC/P03_MAIN/P02_AUXP02_ILC/P02_MAIN/P01_AUXP01_ILC/P01_MAIN										
Name	Owning System	Control	Control State	Active Status	Modem in Use	Good Status Time	Bad Status Time	Active StgConfig		
M004UAR_ALT_ES	m4es	yes	Offline	OFFLINE		08.08.2016 9:45:50.077	01.01.1970 3:00:00.000			
M004UAR_ES	m4es	yes	Offline	OFFLINE		03.11.2016 13:58:48.223	04.10.2016 7:46:20.069			
P0021IB_ALT_ES	m4es	yes	Offline	OFFLINE		01.01.1970 3:00:00.000	01.01.1970 3:00:00.000			
P0021IB_ES	m4es	yes	Offline	OFFLINE		27.10.2016 11:49:42.178	26.10.2016 16:25:27.364			
P0021JAR_ALT_ES	m4es	yes	Offline	OFFLINE		01.01.1970 3:00:00.000	01.01.1970 3:00:00.000			
P0021JAR_ES	m4es	yes	Connecting	CONNECTING		27.02.2017 12:00:05.322	15.10.2016 17:25:15.087	BN1200s1		
P0021JARtest	m4es	yes	Offline	OFFLINE		27.10.2016 11:47:48.042	13.07.2016 14:53:13.344			
P0021MA_ES	m4es	yes	Offline	OFFLINE		27.10.2016 11:55:24.182	26.10.2016 16:25:28.253			
P0021MB_ES	m4es	yes	Offline	OFFLINE		27.10.2016 11:55:27.240	26.10.2016 16:25:28.307			
P0021MC_ES	m4es	yes	Offline	OFFLINE		27.10.2016 11:55:27.240	26.10.2016 16:25:28.253			
P0021NAR_ALT_ES	m4es	yes	Offline	OFFLINE		01.01.1970 3:00:00.000	01.01.1970 3:00:00.000			
P0021NAR_ES	m4es	yes	Offline	OFFLINE		27.10.2016 11:52:36.197	26.10.2016 16:25:32.214			
P0022ID_test	m4es	yes	Offline	OFFLINE		05.11.2015 16:45:09.181	05.11.2015 11:30:54.041			
P0022JAR_ALT_ES	m4es	yes	Offline	OFFLINE		01.01.1970 3:00:00.000	01.01.1970 3:00:00.000			
P0022JAR_ES	m4es	yes	Connecting	CONNECTING		27.02.2017 12:00:05.374	15.10.2016 17:25:15.087	BN1200s1		
P0023IB_ALT_ES	m4es	yes	Offline	OFFLINE		01.01.1970 3:00:00.000	01.01.1970 3:00:00.000			
P0023IB_ES	m4es	yes	Offline	OFFLINE		27.10.2016 11:47:42.360	27.10.2016 10:32:54.023			
P0023JAR_ALT_ES	m4es	yes	Offline	OFFLINE		01.01.1970 3:00:00.000	01.01.1970 3:00:00.000			
P0023JAR_ES	m4es	yes	Offline	OFFLINE		27.10.2016 11:47:39.282	26.10.2016 16:25:27.469			
P0023NAR_ALT_ES	m4es	yes	Offline	OFFLINE		01.01.1970 3:00:00.000	01.01.1970 3:00:00.000			
P0023NAR_ES	m4es	yes	Offline	OFFLINE		27.10.2016 11:47:38.238	26.10.2016 16:25:27.364			
P0024JAR_ALT_ES	m4es	yes	Offline	OFFLINE		01.01.1970 3:00:00.000	01.01.1970 3:00:00.000			
P0024JAR_ES	m4es	yes	Offline	OFFLINE		27.10.2016 11:52:24.443	26.10.2016 16:15:50.265			
P0025JAR_ALT_ES	m4es	yes	Offline	OFFLINE		01.01.1970 3:00:00.000	01.01.1970 3:00:00.000			

Figure 5-4: OASyS Baseline Communications Summary.

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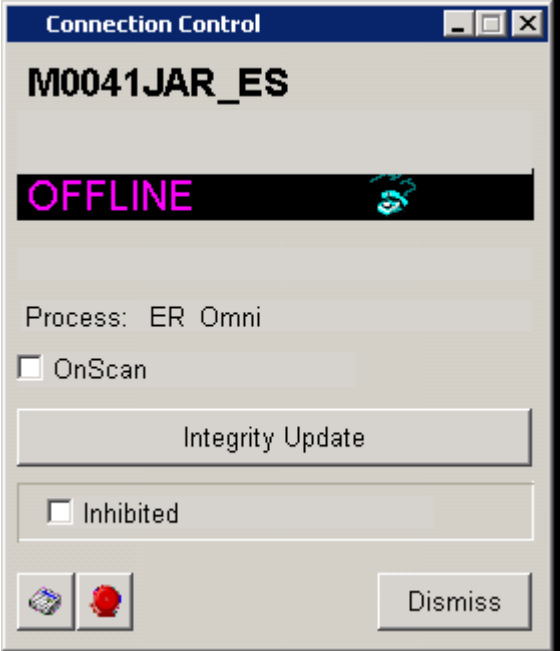




Figure 5-5: OASyS Baseline Connection Control.

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6 PERFORMANCE

Refer to PCS Performance Specification document. [25]

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7 TIME SYNC

NTP service is used to synchronize time across the whole SCADA network. Refer to SCADA Functional Design Specification [1], PLC Functional Design Specification [2] and Metering Functional Design Specification [5] for details.