Telemetry Specification

Revision 00 – 14/05/2020

Control and Intrumentation

Contents

Telemetry Specification

1 RTU REQUIREMENTS

After investigating the latest telemetry technological developments in modern Water and Waste Water installations, as well as taking into consideration the latest security concerns the following mandatory technical requirements for a modern telemetry network have been identified and retained for the selection of RTU's.

- DNP 3 Level 4
- IP based connectivity.
- IEC 61131-3 programming languages
- Conformal coating
- 20 Year life cycle.
- Availability of local technical support
- Availability of recognized and accredited training.
- RTU scalability.
- Peer to peer communication capability.
- RTU digital repeating (Digi-peating) capability or "Store and Forward".

The controller must able to receive information from other sites and retransmit the message to another site, using the same communications port. This should be integrated into the controller's routing configuration.

- RTU Remote configuration and firmware updates capability.
- User friendly RTU configuration software.
- RTU certification/registration with DNP3.org. Device interoperability profiles detailing compliance and level of functionality must be supplied

2 ARCHITECTURE:

Processor

32-bit dual-core Cortex A9 microcontroller, 500MHz

2.1 Memory

- 128MB NAND FLASH, 128MB DDR3 RAM

- Non-Volatile RAM CMOS SRAM with lithium battery retains contents for 2 years with no power

Event logging capacity

Up to 40,000 time-stamped events depending on the protocol

2.2 Database capacity

(1) Up to 20,000 objects (this number decreases if the event pool is above 7,000 events)

2.3 Database concentrator

Up to 15,000 objects depending on the type used (analog or digital)

Up to 100 devices in DNP3 and up to 100 devices in Modbus

File system storage Internal: 10 MB; External: 32 GB (on optional memory stick)

3 COMMUNICATIONS:

3.1 Serial Ports: Serial1, Serial2

- RS-232 port, 8-pin modular RJ45 jack, full or half duplex with RTS/8-8 pin modular RJ45 jack, full or half duplex with RTS/CTS control and operator interface power control, supports baud rates up to 15,200 bps
- Rated to ±15kV (IEC 61000-4-2, Air Discharge) static protection

3.2 Serial Ports: Serial3, Serial4

Configurable as:

- Either RS-232 port, 8-pin modular RJ45 jack, full or half duplex, rated to ±15kV (IEC 61000-4-2, Air Discharge) static protection
- or RS-485 port, 2-wire, half-duplex, supports baud rates up to 115,200 bps

Embedded Wireless

Socket Modem support, for future use

3.3 Serial Protocols

DNP3 level 4 slave/master and peer-to-peer, IEC 60870-5-101 slave, Modbus slave/master

3.4 Ethernet Ports: Eth1, Eth2, Eth3

8-pin modular RJ45 jack, 10/100 Mbps UTP (10/100Base-T), transformer isolated

3.5 IP Protocols

- DNP3 level 4 in TCP Master/Slave, UDP Master/Slave and peer-to-peer, IEC 60870-5-104 Slave,

Modbus/TCP Server, Modbus/TCP Client, Modbus RTU in TCP Client

- NTP Client/Server, Telnet Server, FTP Server, BOOTP Server, Master - Slave capability
- As data concentrator it can manage up to 100 local or remote DNP3 slaves, and up to 100 local slaves communicating with Modbus RTU/TCP
- In peer-to-peer it can connect to up to 90 remote sites
- provides HART 5/6/7 (pass-thru and FB's)

USB Device Port

USB 2.0 compliant "B"-type receptacle, for local configuration.

3.6 USB Host Port

USB 2.0 compliant "A"-type receptacle, supports USB devices up to 32GB (specific memory sticks supported)

4 GENERAL:

4.1 Logic Control

Remote Connect software (IEC 61131-3 languages)

4.2 I/O Terminations

5, 6, 7, 9, 11-pole connectors, 0.0810...3.31mm2 (28...12 AWG), solid or stranded

4.3 Packaging

Corrosion resistant zinc-plated steel with enamel paint

Conformally coated

4.4 Environment

- -40°C to 70°C operating, -40°C to 85°C storage
- 5% RH to 95% RH, non-condensing

Shock & Vibration

IEC 60068-2-27 (tested up to 15g), IEC 60068-2-6

Warranty

3 years on parts and labour

5 POWER SUPPLY

Related Voltage

12...30 Vdc, 5W typical. Limit voltage: 11.5...32 Vdc; turn on voltage: 10...11.5 Vdc; turn off voltage: 9...10 Vdc

5.1 Maximum Power

8.7 W: + 4 x expansion IO modules + USB memory stick

Power Requirements (Controller with integrated IO) 4.8 W

(Expansion IO) 1.1W

USB (5V at 100mA) 0.6 W

Serial port (5V at 250mA) 1.5 W

6 CERTIFICATIONS

EMC & Radio Frequency

FCC 47 CFR Part 15, Subpart B

ICES-003 Issue 5 August 2012

CE and RCM markings

General Safety

UL 508

6.1 Hazardous locations

cCSAus Non incendive Electrical Equipment for use in Class I, Division 2, Groups A, B, C and D

IECEx/ATEX Class1, Class 2

7 DIGITAL AND ANALOG INPUTS/OUTPUTS

Digital inputs 10 ms SOE: 2

Digital inputs 1 ms SOE: 16

Digital outputs MOSFET: 1

Digital outputs 2A: 8

Counter inputs 150Hz (Shared): 4

Counter inputs 1.5 kHz (Shared): 4

Analog inputs: 6

Analog outputs: 2

7.1 Digital Inputs

10 ms SOE: 12…24 Vdc

- • Turn on voltage: 8 Vdc (minimum), Turn off voltage: 3 Vdc (maximum)
- • Over-voltage tolerance: 150% sustained over-voltage without foreseeable damage
- • DC input current: 0.4 mA at 12 Vdc, 0.8 mA at 24 Vdc
- • Time stamping: 10 ms
- • Ground return connected to Chassis Ground 1 ms SOE:
- 12…24 Vdc
- Turn on voltage: 9 Vdc (minimum), Turn off voltage: 4 Vdc (maximum)
- Over-voltage tolerance: 150% sustained over-voltage without foreseeable damage
- DC input current: 1.2 mA at 12 Vdc, 2.4 mA at 24 Vdc, 3.0 mA at 30 Vdc
- Time stamping: 1 ms Sequence of Event
- Isolation: in 2 groups of 8. Isolation from RTU logic and chassis: 1000 Vac/ 1500 Vdc

7.2 Digital Outputs

MOSFET output:

- Sinking MOSFET output, rated 30V, 0.5A, ground return connected to Chassis Ground

2A output:

- Relays (2 Form C, 6 Form A)
- Form C: SPDT, separate Normally Open/Normally Closed/Common
- Form A: Normally Open, one common
- Isolation: 500 Vac minimum to RTU logic
- Maximum Switching Voltage: 30 Vdc or 25 Vac
- Maximum Switching Load: 60 W or 50 VA (2A)
- Status & Reporting: Individual relay pole feedback to software, output state poll
- Controls: Direct Operate, Select Before Operate, Trip/Close, Latch, Pulse

Counter Inputs

- Shared with digital input channels 1 to 4: 0…1.5kHz, 5 to 8: 0…150Hz

7.3 Analog Inputs

6, dipswitch-configurable to 4...20 mA, 0...20 mA or 1...5 V, 0...5 V

- Uni-polar, differential, voltage or current
- Resolution: 24-bit ADC (16-bit over the measurement range)
- Accuracy: ±0.1% of full scale at 25°C (77°F), ±0.2% over temperature range
- Isolation: 250 Vac isolation from channel to channel and from RTU logic and chassis
- Input Resistance: 250 Ω or 800 kΩ in current/voltage configurations
- Under range: 4...20 mA measures to 0 mA
- Common Mode Rejection: -80dB (50/60Hz)
- Sampling rate: software selectable to 30 ms (unfiltered) or 500ms (filtered)

7.4 Analog Outputs

2 X 0...20 mA, 4...20 mA, voltage output may be accomplished with external precision resistor

- Uni-polar
- Resolution: 12-bit over 0...20 mA range
- Accuracy: ±0.15% at 25°C, ±0.35% of full scale over temperature range
- Response Time: less than 10 µs for 10% to 90% signal change
- Power Supply: 12…30 Vdc, external
- Power (Current) Requirements: 10 mA plus up to 20 mA per output
- Isolation: transformer, 500 Vdc maximum to RTU logic and chassis
- Load Range: 12 Vdc: 0…475Ω, 24 Vdc: 0…1075Ω, 30 Vdc: 250…1375Ω
- Logic End)-Of- Scan to Signal Update Latency: less than 10 ms (typically 5...8 ms)
- Status & Reporting: Open Loop status, output value poll
- Controls: Direct Operate, Select Before Operate

7.5 Internal power monitor

Power input - analog input and low indication, on board lithium battery - low indication

Internal temperature monitor

Controller temperature range -40°C…+75°C

8 ADDITIONAL I/O

I/O Expansion Maximum number of modules per unit:15

9 RADIO SPECIFICATIONS FOR HALF DUPLEX MODE

9.1 Radio:

Frequency range:	400-450MHZ (L-band)
Frequency Splits:	Configurable
Channel selection:	3.125 kHz channel steps
Channel spacing:	12.5 and @ 5 kHz (software selectable)
Frequency accuracy:	±0.5ppm -40 to 70°C ambient
Aging:	<=1ppm/annum
Radio modes:	Simplex and Half duplex

9.2 Transmitter:

Tx power: 0.05 to 10 W (+17to +40 dBm) ±0.1 dB configurable with over temperature and high VSWR protection

Modulation:	Narrow band 2, 4, 8 and 16 level continuous phase modulation
Tx Keyup Time:	<1ms
Timeout timer:	configurable 0-255 sec.
Tx spurious:	<= -37 dBm
PTT control:	Auto data/RTS line on data port

9.3 Receiver:

AFC tracking:	Digital receiver frequency tracking
Mute:	Configurable digital mute

9.4 Connections

Serial interface 1/2: 1X RS232 DB9 female connector providing 2X RS 232 3 wire serial port (shared connector) 300-38400 bps asynchronous

Serial interface Speeds: From 600 bps to 115 200 bps

Serial interface flow control: configurable hardware / 3 wire interface

Serial interface DCD control: Configurable DCD operation: activated on RF carrier or from user data input.

Ethernet port: 2X RJ45; 10/100 Mbps (auto-MDIX sensing) compliant with IEEE 802.3

Antenna: 1x TNC female bulkhead

Power: 2 pin locking Mating connector supplied

LED display: Multimode indicators for DC power, transmit, receive, Synchronised data, serial interface, Ethernet 1&2 Transmit and receive data.

9.5 Ethernet

Supported Protocols: Ethernet (including UDP, TCP, DHCP, ARP, ICMP, STP, IGMP, SNTP & TFPT)

Ethernet Repeating: Automatic Peer to Peer repeating

Operating Modes: Layer-2 Ethernet Bridge mode / Layer-3 lP Router mode

Ethernet Traffic Filtering: Configurable: No Filtering / Unicast Traffic & ARP Only/ Unicast Traffic Only / List of approved MAC addresses

Compression: Automatic data compression

Terminal Server: Legacy RS-232/RS-485 serial support via embedded terminal server (UDP/TCP)

lP Configuration: Auto (DHCP) and Manual

SNMP: SNMP V1, V2c, RFC 1213-compliant & radio diagnostics parameters (with notifications)

Modbus Gateway: Configurable Modbus / TCP to Modbus / RTU Gateway Time Server:

NTP Client / Server / Client-Server / Manual modes

9.6 Modem

Dynamic Speed Selection: QoS / RSSI based Automatic Speed Selection or Fixed speed mode

Operating Modes: Base, remote, repeater or store 'n' forward

Channelshare+ TM: Advanced dynamic supervisory collision avoidance system

Backward Compatibility: Backward compatible with Trio E-Series radios

Firmware: Local and over-the-air flash-based firmware upgradable patches with support for broadcast updates

9.7 Security:

Encryption: 256-bit AES

HTML Interface: Password Protected HTTP and HTTPS configuration and management interface

Console Interface: Password protected Telnet, SSH and Serial console interface

Password Protection: Password protected configuration sessions

9.8 Diagnostics

Diagnostics Overview:

- Network management and diagnostic Windows GUI software
- Network-wide operation from any remote terminal
- Non-intrusive protocol - runs simultaneously with the application
- Storage of data error and channel occupancy statistics
- Embedded Error Rate testing capabilities
- Diagnostics parameters available
- Transmitter Power
- Received Signal Strength
- DC Supply Voltage
- Received Frequency Offset Radio Temperature
- VSWR

Logging: Embedded event and performance logs including time stamped data statistics and channel occupancy

Diagnostics & Configuration: Configuration via embedded HTTP, HTTPS web interface and/or Telnet/SSH /Serial console

Ping Tester: Embedded ping test facility

9.9 General

Operating Temperature Range: -40 to +70°C ambient

Cooling: Built in temperature controlled fan

Input Voltage: 10-30 VDC

Input Power (Tx Typical): 24 W@ 30dBm, 37 W @ 37dBm , 54 W @ 40dBm

Input Power (Rx Typical): 5 W

Housing & Dimensions rugged Die-cast 115x 34x164mm

Mounting: integrated mounting holes or DIN rail.

Weight: 0. 5kg

Warranty 3 years on parts and labour from time of installation

9.10 Approvals and Certifications

Europe (ETSI): ETSI EN 300 113, EN 301 489, EN 60950, EN 50385, EN 50383.

United States (FCC): FCC PART 15, PART 90

Canada (IC): IC RS119, ICES-001

10 RADIO SPECIFICATIONS FOR FULL DUPLEX MODE

10.1 Radio:

Frequency range: 400-450MHZ (L-band)

Frequency Splits: Various TX/ RX frequency splits, Configurable

Channel selection: 3.125 kHz channel steps

Channel spacing: 12.5 and @ 5 kHz (software selectable)

Frequency accuracy: ±0.5 ppm -40 to 70°C ambient

Aging: <=1ppm/annum

Radio modes: Full duplex

10.2 Transmitter:

Tx power: 0.05 to 10W (+17to +40 dBm) ± 0.1 dB configurable with over temperature and high VSWR protection

Modulation: Narrow band 2, 4, 8 and 16 level continuous phase modulation

Tx keyup time: <1ms

Timeout timer: configurable 0-255 sec.

Tx spurious: <= -37 dBm

PTT control: Auto data/ RTS line on data port

10.3 Receiver:

AFC tracking: Digital receiver frequency tracking

Mute: Configurable digital mute

10.4 Connections (for each QB within the hot standby configuration)

Serial interface 1/2: 1X RS232 DB9 female connector providing 2X RS 232 3 wire serial port (shared connector) 300-38,400 bps asynchronous

Serial interface flow control: configurable hardware / 3 wire interface

Serial interface DCD control: Configurable DCD operation: activated on RF carrier or from user data input.

Ethernet port: 3X RJ45; 10/100 Mbps (auto-MDIX sensing) compliant with IEEE 802.3

Antenna: 2x N female bulkhead (separate TX and RX ports-full duplex)

Power: 2 pin locking mating connector supplied

LED display: Multimode indicators for DC power, transmit, receive, Synchronised data, serial interface, Ethernet 1&2 Transmit and receive data.

10.5 Ethernet

Supported Protocols: Ethernet (including UDP, TCP, DHCP, ARP, ICMP, STP, IGMP, SNTP & TFPT)

Ethernet Repeating: Automatic Peer to Peer repeating

Operating Modes: Layer-2 Ethernet Bridge mode / Layer-3 lP Router mode

Ethernet Traffic Filtering: Configurable: No Filtering / Unicast Traffic & ARP Only / Unicast Traffic Only / List of approved MAC addresses

Compression: Automatic data compression

Terminal Server: Legacy RS-232/RS-485 serial support via embedded terminal server (UDP/TCP)

lP Configuration: Auto (DHCP) and Manual

SNMP: SNMP V1, V2c, RFC 1213-compliant & radio diagnostics parameters (with notifications)

Modbus Gateway: Configurable Modbus/TCP to Modbus/RTU Gateway

Time Server: NTP Client/ Server/ Client-Server/ Manual modes

10.6 Hot standby

Change over control: Manual (front panel switched)/ automatic upon alarm / automatic upon timer / remote (software driven)

Alarm Monitoring: General Alarms / Transmitter / Receiver / Received Signal Strength / Received Data Errors / Ethernet Connectivity / Power Supply

10.7 Modem

Dynamic Speed Selection: QoS/ RSSI based Automatic Speed Selection or Fixed speed mode

Operating Modes: Base, remote, repeater or store 'n' forward

Channelshare+ TM: Advanced dynamic supervisory collision avoidance system

Backward Compatibility: Backward compatible with Trio E-Series radios

Firmware: Local and over-the-air flash-based firmware upgradable patches with support for broadcast updates

10.8 Security:

Encryption: 256-bit AES

HTML Interface: Password Protected HTTP and HTTPS configuration and management interface

Console Interface: Password protected Telnet, SSH and Serial console interface

Password Protection: Password protected configuration sessions

10.9 Diagnostics

Diagnostics Overview:

- Network management and diagnostic Windows GUI software
- Network-wide operation from any remote terminal
- Non-intrusive protocol - runs simultaneously with the application
- Storage of data error and channel occupancy statistics
- Embedded Error Rate testing capabilities
- Diagnostics parameters available
- Transmitter Power

- Received Signal Strength
- DC Supply Voltage
- Received Frequency Offset Radio Temperature
- VSWR

Logging: Embedded event and performance logs including time stamped data statistics and channel occupancy

Diagnostics & Configuration: Configuration via embedded HTTP, HTTPS web interface & or Telnet/SSH /Serial console Ping Tester: Embedded ping test facility

10.10 General

Operating Temperature Range: -40 to +70°C ambient

Cooling: Built in temperature controlled fan

Input Voltage: 10-30 VDC

Input Power (Tx Typical): 76 W@ 30dBm, 92 W @ 37dBm, 106 W @ 40dBm

Input Power (Rx Typical): 35 W

Protection mode: Automatic or manual change over between QB 450 units

Housing & Dimensions: Hot stand by is configured using two QB450 +ix hot standby controller (19" 1 RU each) for a total of 19" (483mm) 3 RU rack mount

Weight: 15kg

Warranty 3 years on parts and labour form time of installation

10.11 Approvals and Certifications

Europe (ETSI): ETSI EN 300 113, EN 301 489, EN 60950, En 50385, EN 50383.

United States (FCC): FCC PART 15, PART 90

Canada (IC):

11 SPECIFICATIONS FOR CELLULAR GATEWAY

11.1 Cellular interface:

The router shall be able to connect to network of the main South African cellular service suppliers: MTN, Vodacom, Telkom, and Cell C.

The cellular interface shall be multi-band and able to operate at the following frequencies and standards for: GSM/GPRS/EDGE/UMTS/HSPA/LTE Band options:

- 2G: GSM B3 (1800MHz), B8 (900 MHz),
- 3G: UMTS/ HPSA B1 (2100 MHZ), B5 (850 MHz), B8 (900MHz)
- 4G: LTE B1 (2100 MHZ), B3 (1800 +MHz), B40 (2300MHZ)

11.2 Software:

Network protocols: TCP/IP, UDP, ARP, DNS, DHCP, ICMP, (SNTP client) , SNMP, HTTP, HTTPS, SMTP, NTP, DDNS.

Routing/ Firewall: NAT, VPN tunnel, port forwarding, IP/MAC port filtering, Access IP list.

VPN: The IPsec VPN service shall provide secure Internet Protocol (IP) communications by authenticating and encrypting each IP packet of a communication session

Open VPN (server/Client)

Tunnel mode (routing) and TAP mode (bridge)

Encryption: Blowfish CBC, DES CBC, DES-EDE3 CBC, AES-

128/192/256 CBC •

NAT-T, PFS, DPD

• Throughput:

> 20 Mbps max.

> Concurrent VPN Tunnels: Max. of 5 (Responder/Initiator)

Applications: Real COM, Reverse Real COM, TCP Server, TCP Client,

UDP, RFC2217

Management Options: Remote SMS Control, SNMPv1/v2c/v3, Web / Telnet / Serial

Console, alarm via Email, SMS, SNMP trap

11.3 SIM Interface

Number of SIMs: 2, full-sized (1FF)

11.4 Serial Interface

Number of Ports: 1

Serial Standards: RS-232/422/485, software selectable

Connector: DB9 male Serial Communication Parameters

Data Bits: 5, 6, 7, 8

Stop Bits: 1, 1.5, 2 (when parity = None)

Parity: None, Even, Odd, Space, Mark Baud rate:

75 bps to 921.6 kbps

11.5 Serial Signals

RS-232: TxD, RxD, RTS, CTS, DTR, DSR, GND

RS-485-4w: Tx+, Tx-, Rx+, Rx-, GND RS-485-2w: Data+,

Data-, GND

11.6 Physical characteristics:

Housing: Metal, providing IP30 protection or better

11.7 Environmental Limits

Operating Temperature: -30 to 70°C

Storage Temperature: -40 to 85°C)

Ambient Relative Humidity: 5 to 95% (non-condensing)

11.8 Power Requirements

Number of Power Inputs: 2 (terminal block), redundant dual inputs

Input Voltage: 12 to 48 VDC

Input Current: 0.7 A @ 12 VDC; 0.2 A @ 48 VDC

Reverse Polarity Protection: Present Standards and Certifications

Safety: UL 60950-1

EMC: EN 61000-6-2/6-4

EMI: CISPR 22, FCC Part 15B Class A EMS:

IEC 61000-4-2 ESD, Level 4: Contact: 8 kV; Air: 15 kV

IEC 61000-4-3 RS, Level 3: 80 MHz to 1 GHz: 10 V/m

IEC 61000-4-4 EFT, Level 3: Power: 2 kV; Signal: 1 kV

IEC 61000-4-5 Surge, Level 3: Power: 2 kV; Signal: 1 kV

IEC 61000-4-6 CS, Level 3: 10 V; 150 kHz to 80 MHz

IEC 61000-4-8, Level 4: 30 A/m

Freefall: IEC 60068-2-32

Vibration: IEC 60068-2-6 Shock:

IEC 60068-2-27 Radio:

- FCC ID N7NMC7355
- EN 301 489-1, EN 301 489-7, EN 301 511/4

11.9 MTBF (mean time between failures)

Time: > 528,596 hours Standard:

Telcordia SR332

11.10 Warranty:

The router shall have a 5 years manufacturer warranty starting from the time of installation.

12 Functional Descriptions

12.1 Intruder Alarm

The intruder alarm shall be activated by the motion detector upon entry into the Telemetry Room for a period of 15 minutes, however the timer shall continue to reset upon each subsequent movement. If no movement is detected after a period of 15minute the alarm shall be reset.

Telemetry Panel door alarms shall activate when any door is opened. The alarm shall remain active as long as the door is open. The alarm shall reset when the door has been closed.

12.2 Inlet Valve Control

The reservoir Inlet Valve shall have two modes of operation which shall be set in the RTU by the operator via the Scada.

Mode 1 – Tele-Override operation.

In Tele-Override mode the operator shall be able to open and close the Inlet Valve at any time.

Mode 2 – Automatic operation

In Automatic mode the Inlet Valve shall be opened and closed depending on the reservoir level which shall be monitored by means of an Ultrasonic Level Transmitter. The transmitter shall send the measured variable via an RS485 link to the RTU. Upper and Lower set points shall be set in the RTU for valve operation. The Inlet Valve shall Close on the Upper limit and Open on the Lower limit.

As the Inlet Valve does not have position feedback the solenoid output voltage shall be monitored as an indication that the solenoid valve has been activated.

Required Hardwired I/O

DIN 1 Inlet Valve power on to Open DOT 1 Inlet Valve

Open/Close output

Required RTU Soft I/O:

DIN 2	Inlet Valve Open/Close command selected.
DIN 3	Tele-Override On/Off
DIN 4	Valve open in Auto
DIN 5	Valve close in Auto

AI	Reservoir Level
AO 1	Level Upper Limit Set point from SCADA
AO 2	Level Lower Limit Set point from SCADA

12.3 Pump Calls

Each pump shall have two modes of operation which shall be set in the RTU via the Scada by the operator.

Mode 1 – Tele-Override operation.

In Tele-Override mode the operator shall be able to Stop and Start the pump at any time.

Mode 2 – Automatic operation

In Automatic mode the pump start/stop call signal is received from the remote reservoir. At the remote reservoir the ultrasonic level transmitter shall send the measured variable via an RS485 link to the RTU which shall determine the pump stop/start call. Upper and Lower set points shall be set in the RTU for pump operation. The pump shall Stop on the Upper limit and Start on the Lower limit.

<u>Pump Station</u>

Required Hardwired I/O:

DIN 1	Pump Running
DIN 2	Pump Trip
DIN 3	Pump in Manual (Selector switch)
DOT 1	Tele-Override On
DOT 2	Pump Stop/Start in Tele-Override
DOT 3	Pump Stop/Start in Auto

RTU Soft I/O:

DIN 4	Pump Tele-Override Stop/Start selected
DIN 5	Tele-Override On/Off
DIN 6	Pump Duty received from reservoir
DIN 7	PLC Communications Fail

<u>Reservoir</u>

Required Hardwired I/O:

AI	Reservoir Level

RTU Soft I/O:

AO 1	Level Upper Limit Set point from SCADA
AO 2	Level Lower Limit Set point from SCADA
DIN 1	Pump duty call sent to Pump Station

12.4 Level Transmitter Functions

Each Reservoir shall be monitored by means of an Ultrasonic Level Transmitter. The transmitter shall send the measured variable via an RS485 link to its respective RTU.

The following variables shall be monitored by the RTU.

Required RTU Soft I/O

AI	Reservoir Level
DIN 1	Level Transmitter Communications Failure
DIN 2	Level Sensor Cable Fault
DIN 3	Level Sensor Loss of Echo