Introduction

Auckland Council wishes to install a tide gauge system on the Weiti Boat Club wharf. Auckland Council visited the Weiti Boat Club wharf on the 27th Feb 2017 to visually assess the boat club's wharf structure. The wharf ticked all of the boxes in respect to its suitability as a potential site for a tide gauge. There were also a number of advantages your structure has over other structures in the area, which are: security, mains power and having water under the wharf during all stages of the tide. All of which are important variables in selecting a good site.

There are some benefits for the Weiti Boat Club in regards to the installation of a tide gauge at the wharf. The tide gauge data will be live (10min updates) and will be made available to the boat club and its members. The data can be viewed via the internet, so members can look at it via their computer or phone. Also the tide data will be directly applicable to your boat club and provide real data on tide levels therefore the club will not have to rely on the modelled tide estimates provided by other parties.

The tide gauge would consist of a water level sensor, an attachment bracket (if this designed is the prepared design) and a secure logger box. Images of these components are presented below.

This letter is intended to provide specific design and installation details to the Weiti Boat Club to facilitate a discussion in respect to agreeing upon the installation design and placement of the tide gauge on the wharf.

Background

An accurate understanding of tidal ranges across the region is required by Auckland Council to inform a range of assessments and decision making, including:

- Design water levels for coastal engineering design;
- Increased tidal levels from storm surge and ongoing sea-level rise;
- Design of appropriate habitable floor levels;
- Contributing to the LINZ New Zealand Vertical Datum 2016; and.
- Joint probability assessments of coastal inundation and catchment flooding.

The above are intrinsically related to the understanding and implications of coastal inundation risk. This is considered to be one of the most significant hazards facing the Auckland Region and presents a further increasing risk over time with sea-level rise. A range of factors contribute to extreme water levels; astronomic tides, storm surge, monthly mean sea level, climate change effects and, tsunami. However, in New Zealand, astronomical tides have the largest influence on sea-level (Stephens, 2013). As a result, it is fundamental that Auckland Council develops a robust tidal dataset at key strategic locations around our coastline.

Rationale

In 2013, Auckland Council Civil Defence Emergency Management commissioned NIWA to determine extreme water levels around the Auckland coast and map the associated extent of inundation. This was further refined by Auckland Council Coastal Management Services with NIWA and DHI in 2016 for the Parakai/Helensville region and a number of the small estuaries on the east coast. Overall, the mapping provides Auckland Council with an appreciation of coastal inundation risk across the region under a range of coastal storm surge, wave set-up and sea-level rise scenarios as required under the RMA and NZCPS. The gauge records are crucial because they enable extreme sea-level analyses to be made, founded on actual sea-level measurements. These are then used to validate extreme sea-level estimates based on modelled data. However, an understanding of extreme sea-level is needed throughout the Auckland region. These levels change with location as the coastal dynamics (including tide, storm surges and wave set-up) vary with the local environment. As a result, hydrodynamic models are used to determine extreme sea-level across the Auckland coast and sea-level components were calculated differently for three different physical coastal environments:

- Major Harbours;
- Open Coast; and
- Small east coast harbours and estuaries.

The varied approaches have highlighted the need for developing a wider network of tide gauges in the Auckland Region. This particularly relates to the small east coast estuaries where storm tides were not modelled dynamically and elevations were based on storm tide calculations at their entrance and scaled with distance inland given the limited amount of sea-level data available at these locations. As a result, there are opportunities to improve our understanding of coastal inundation in these areas through establishment of a long term dataset going forward.

As previously noted, the 2013 regional coastal inundation mapping was originally commissioned by CDEM for emergency management purposes, communicating the areas potentially exposed to inundation in the present day and over time.

Following its release, the mapping and associated extreme water levels have been applied within the development of Auckland Council's Unitary Plan. The mapping is used to identify land potentially exposed to coastal hazards, currently within a control layer of the Decision Version of the Plan. The associated report is also applied within the plan to ensure the design of appropriate habitable floor levels for any development identified within this area.

Equipment to be installed

There is a generic ‘tide gauge’ set up that requires installation at each site. This consists of:

- VegaPuls WL61, a radar based water level sensor;
- AquiStar PT12-BV Barometric/Vacuum sensor and
- IQuest IRIS 350FX Wireless data logger and modem.

Specifications for the above instrumentation are provided in Appendix A.

There will be site specific installation needs to facilitate completion. However Auckland Council envisions the need to also install

- secure metal boxes to contain data loggers, telemetry, solar power and batteries,
- solar panel – where mains power is not easily accessible
- plastic conduit, mounting saddles and attachments to run cables from the sensors to the data loggers
- mounting bracket to secure the VegaPuls WL61 (water level sensor) to the structure. The exact location will be determined with the Weiti Boat club.
- staff gauge to validate data collected by the water level sensor

Proposed sites

Tide gauge are to be installed at six sites (Omaha, Weiti River, Panmure, Hingaia, Waiapa, Helensville) and maintained by Auckland Council over the course of a minimum of 5 years. These tide gauges will complement the currently installed gauges at Port of Auckland and the Onehunga wharf (Manukau Harbour).

Figure 1. Regional coverage of proposed and existing tide gauges, yellow pins = proposed sites, red pins = existing tide gauges.

Weiti Boat Club wharf

Auckland Council proposes to install a tide gauge on the wharf of the Weiti Boat Club.

The Weiti Boat club wharf is located in an area where long term consistent water level data are lacking or have minimal coverage. The installation of a tide gauge at this location will provide the required data to inform all of the issues outlined in above. The wharf at this site facilitates the installation of a tide gauge by providing a permanent fixed structure; water is present the wharf at all stages of the tide, ease of access and good security.

The details of the installation of the tide gauge are still to be discussed with the Weiti Boat Club, however in general it was agreed that the tide gauge could be located

near the end of the wharf adjacent to the walkway which extends to the floating pontoon.

Auckland Council requests the permission to install

- secure metal logger box to contain data loggers, telemetry and circuitry
- solar panel – where mains power is not easily accessible
- plastic conduit, mounting saddles and attachments to run cables from the sensors to the data loggers
- either
  a mounting bracket to secure the VegaPuls WL61 (water level sensor) to the structure or
  a look through install which utilises a hole cut through the wharf deck
- staff gauge to validate data collected by the water level sensor

Below are graphics that display proposed position of the metal logger box (Fig 2), and two proposed options for the placement of the water level sensor (Fig 3 and 4).

Only one option is needed, but two options are presented for the Weiti Boat Club's consideration. Also requested is the installation of a staff gauge to calibrate and ground truth the data collected form the water level sensor (see Fig 5 for picture of a staff gauge) and access to main power. If connecting to the main power is not acceptable the installation of a solar panel is required.

To facilitate the discussion we propose some of the following options for the types of material to construct the attachment.

1. A "look-through" install is proposed where a hole (maximum diameter 120 mm) is cut through the decking (see Fig 3) of the wharf. The water level sensor then "looks-through" the hole and is secured to the surrounding decking using a stainless steel flange adapter (see figure 6 for details of the adapter). The flange will be secured to the deck using 8 x M6 x 50mm coach screws (SS 316). This type of install will be hidden with the placement of the metal box over the water level sensor. This design has advantages in that there are no attachments hanging off the side of the wharf and will not hinder daily wharf operations.

2. The second attachment design is a bracket that slides under the toe-kick edge barrier of the wharf deck. Figure 4A and 4B show the position of the white toe-kick and bracket design placed under the toe-kick. The bracket is to be fabricated from galvanised square tube. The main arm (40 x 40 x 400 mm long) will have two support arms (40 x 40 x 450 mm long). All three arms are to be welded to equal angle (75 x 75 x 5 x 500 mm (L)) galvanised plate which will be slightly lower than the top of the white toe kick. The bracket will be secured to the wharf deck using 3 x

8mm x 75mm galvanised coach screws. The water level sensor and bracket arms will extend ~300mm off the side of the wharf.

Figure 2. Shows relative position and proportions of the metal logger box proposed to be installed near the end of the wharf. The orientation of the box can be turned so to occupy less deck space.

Figure 3. Shows proposed position for a “look-through” installation (blue and red circle, 120 mm diameter). The metal logger box will be placed over the hole as displayed in Fig 2 above.

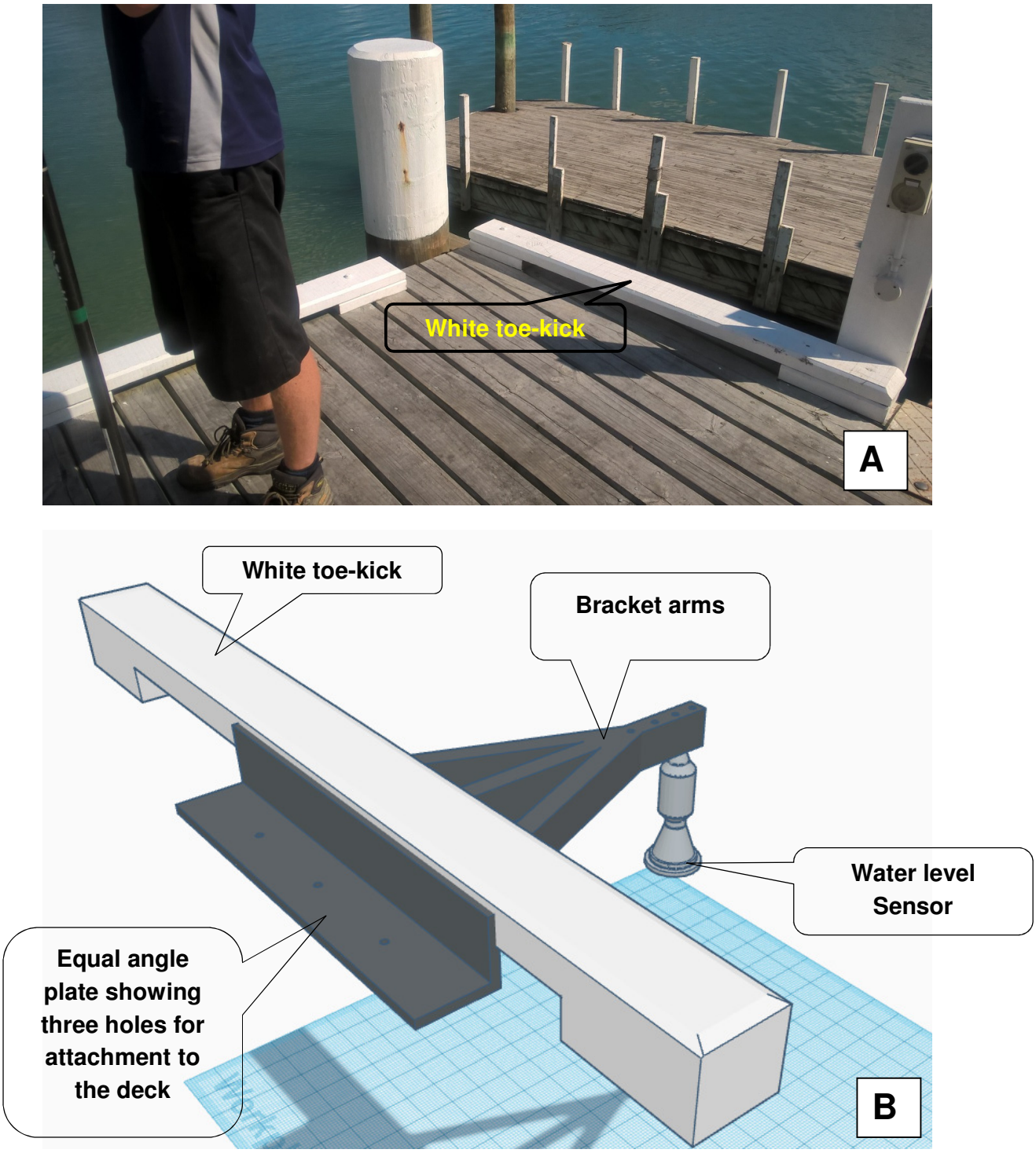


Figure 4. Photo A shows the position of the white toe-kick edging of the wharf while photo B is a render of the proposed attachment bracket placed under the white toe-kick. The water level sensor is suspended off the edge of the wharf with a clear line of sight of the water.

Staff gauge

Auckland Council also seeks permission to install a staff gauge. A staff gauge is necessary to validate the readings collected via the water level sensor. This will allow Auckland Council to have greater confidence in the data collected in respect to water levels.

The staff gauge is basically a ruler that we propose to attach to a wharf pile (see Fig 5A and 5B). The staff gauge needs to be in a location that the gauge can be easily observed to take visual readings, will not be damaged during the operational activities associated with the wharf and can be scrubbed cleaned of marine fouling on occasion.

We proposed the gauge to be installed against one of the piles where the water level sensor is to be installed. The staff gauge will be screwed to the wharf pile using stainless (316) 8 x 50mm CSK square screws.

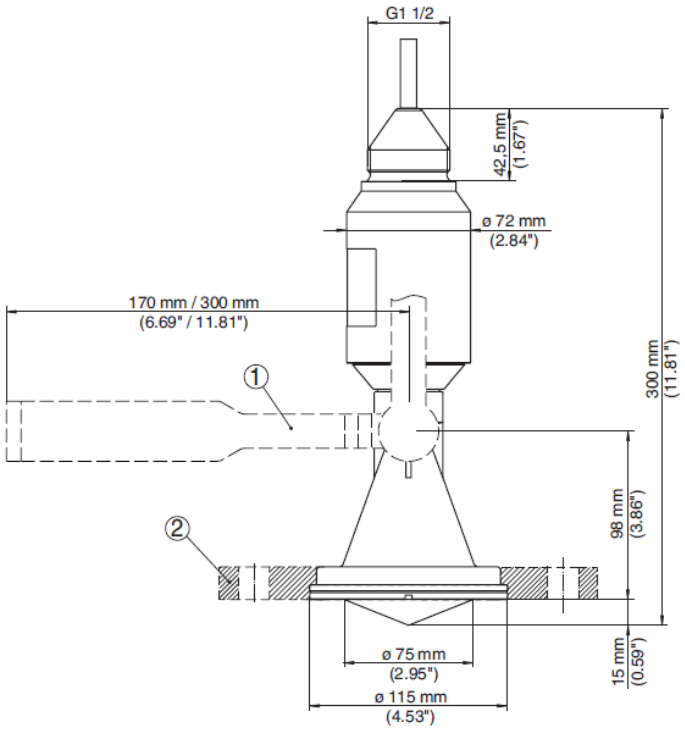
Figure 5. Staff gauge design (photo A) and suggested placement of a staff gauge on wharf pile (photo B).

The water level sensor

The sensor is relatively small piece of equipment (see Figure 6) and weighs approximately 3 kgs. The installation specification requires the senor be place at least 200mm away from any object that may interrupt the emitted radar pulse and its return from the water's surface. Of the above materials described, all are capable of

holding and securing the water level sensor to the wharf and have been specified to allow at least a 200mm clearance.

Dimensions



Dimensions VEGAPULS WL61

1 *Mounting strap*
2 *Adapter flange*

Figure 6. Images of the water level sensor with associated dimensions.

Electrical supply

The water level sensor will need an electrical supply. There are two options for electricity access:

1. Direct access to the electrical supply on the wharf
2. Solar supply and installation of solar panel and associated wires

The first option requires the additional permission of the Weiti Boat Club. Electrical usage of the tide gauge is estimated to be $1 - $1.50 per week. Electrical installation and associated installation will need to be undertaken by a certified electrician and

the installation costs will be Auckland Council's responsibility. We proposed to tap into the main supply from the power outlet displayed in Figure 7.

Figure 7. Power outlet adjacent to floating pontoon walkway

The second option requires the installation of a solar panel on a pole in close proximity to the logger box. The solar panel will power the entire installation by charging batteries contained within the secure logger box. The solar panel could be attached to the upper portion of the lamp post which supports the no swimming, no fishing, and no smoking sign.

Secure logger box design

The logger box will be installed to house data loggers, communications componentry, batteries and power converters and supply (see Fig 8 for dimensions of the logger box). The logger box will be placed near the southern end of the wharf (see Fig 2). The logger boxes will be a small MK3 Montrose box. Further details and dimensions are provided in Appendix A. The logger box will need secured to the decking of the wharf using 4 x 8mm x 75mm galvanised coach screws.

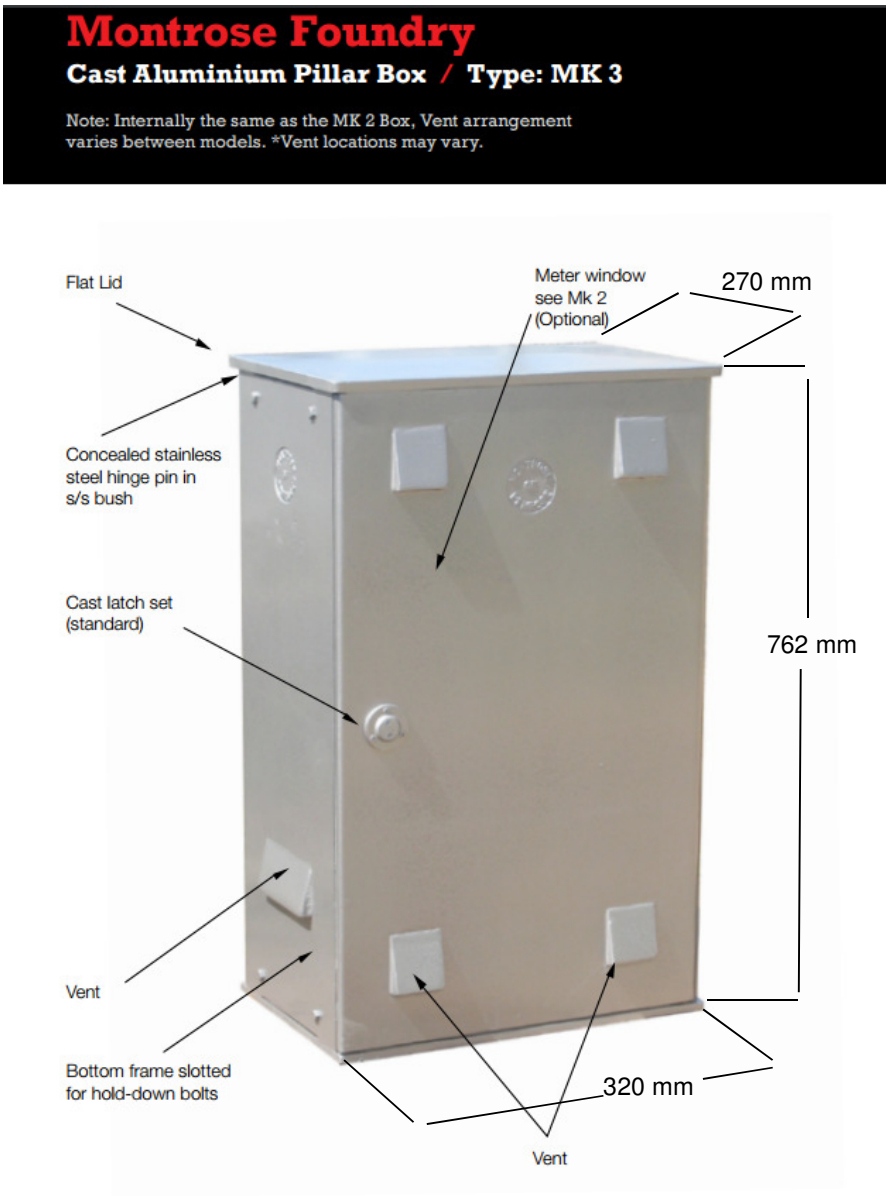


Figure 8. Montrose secure logger box with external dimensions

Appendix A

Water level sensor

Specification sheet

VEGAPULS WL61

4 … 20 mA/HART - two-wire

Radar sensor for continuous level measurement of water and wastewater

Application area

The VEGAPULS WL61 is the ideal sensor for all applications in water and sewage water applications. It is particularly suitable for use in water processing, pump stations as well as overflow basins, for flow measurement in open flumes and gauge monitoring. The VEGAPULS WL61 is an economical solution through versatile and simple mounting options. The flood-proof IP 68 housing ensures a maintenance-free permanent operation.

Your benefit

- Maintenance-free operation thanks to non-contact measuring principle
- High plant availability, because wear and maintenance free
- Exact measuring results independent of product, process and ambient conditions

Function

Extremely short microwave impulses are emitted by the antenna system in the direction of the measured product, reflected by the product surface and received back again by the antenna system. The time from emission to reception of the signals is proportional to the level.

Technical data

Measuring range up to	15 m (49.21 ft)
Deviation	±2 mm
Process fitting	Thread G1½, mounting strap, compression flanges from DN 80, 3"
Process pressure	-1 … +2 bar/-100 … +200 kPa (-14.5 … +29.0 psig)
Process temperature	-40 … +80 °C (-40 … +176 °F)
Ambient, storage and transport temperature	-40 … +80 °C (-40 … +176 °F)
Operating voltage	9.6 … 36 V DC

Materials

The wetted parts of the instrument are made of Valox PBT or PP. The process seal is made of FPM. The connection cable is PUR insulated. You will find a complete overview of the available materials and seals in the "*Configurator*" at www.vega.com and "*VEGA Tools*".

Housing versions

The housing is optimized for applications in the waste water industry and manufactured of Valox PBT. Due to the encapsulated cable gland, protection rating IP 68 (2 bar) is achieved.

Electronics versions

The instruments are available in different electronics versions. Apart from the two-wire electronics with 4 … 20 mA/HART, two purely digital versions with Profibus PA and Foundation Fieldbus are possible.

Approvals

The instruments are suitable for use in hazardous areas and are approved, for example, according to ATEX and IEC.
You can find detailed information at www.vega.com/downloads and "*Approvals*".

Barometric sensor

PT12-BV
BAROMETRIC/ VACUUM SENSOR

AquiStar Data Collection Systems

APPLICATIONS

Barometrically compensate absolute pressure sensors for level measurement

Measure vacuum pressure during vapor extraction pilot testing

Supplement aquifer test data in leaky or confined conditions

Measure accurate barometric pressure

No vented cable or desiccant tubes needed

Features

- Available in three versions
  - Weatherproof box
  - 316 stainless or titanium tube
  - Automatic barometric compensator available
- SDI-12 v1.3 interface and/or Modbus® RTU interface *(depends on version)*
- Pressure/vacuum and temperature
- Polyethylene, polyurethane and FEP cable options

INW *True data, measure by measure*

ISO

1-800-PRO-WELL
WWW.INWUSA.COM
CE

Data logger and modem

iRIS 350FX Wireless (IP Capable) Datalogger

iQUEST

The iRIS 350FX has been designed and constructed for use in harsh outdoor and industrial environments. It is compact, cost effective and easily configured, with support for a wide range of instrumentation. It has four physical communication interfaces:

- RS232 port (DTE configuration).
- Optional wireless 3G modem. Or a custom comms adaptor module.
- SDI-12 serial instrumentation bus port.
- Serial camera (iRIS-CAM).

Data may be accessed / downloaded in several ways:

- Direct RS232 connection e.g. laptop or data radio.
- IP based packet transfer (TCP/UDP).
- Automatic FTP data file transfer to one or two destinations.
- SMS text back (current sensor values).
- Voice annunciation (iRIS 350FXV only).
- DNP3 - customised software variant available on request for specific applications such as water metering on magnetic, Doppler and ultrasonic flow meters.

GENERAL DESCRIPTION

LCD / Keypad User Interface
The iRIS 350FX has a small graphics LCD with 4 text lines of 19 characters, plus a small set of pictorial icons. This display, in conjunction with the 4 button keypad provides a simple yet versatile method of viewing general and sensor information as well as running totals etc

Power Supply
The default power supply for the iRIS 350FX is an internal and/or external 12V rechargeable SLA battery. Two high efficiency switch-mode regulators are used to charge the battery and supply all other onboard requirements. Both the battery voltage and charger input voltage are monitored internally and are available to be logged, displayed or alarmed.

Temperature Measurement
The iRIS 350FX (PCB) temperature is also monitored. This can also be read and logged as a scaled -30.0°C to +70.0°C (-22 °F to +158 °F) range.

Real Time Clock / Calendar.
This is backed up by a replaceable on-board lithium battery to prevent loss of date/time if the main battery or supply is disconnected.

Processor
The iRIS 350FX processing core uses a high performance, multi-speed (max 100MHz) micro-controller. The CPU speed is varied to minimise power consumption, but when needed, handle intensive computing tasks.

Memory
A total of 16MB of flash memory is provided. Of this, 8MB is allocated for logged data and/or image storage. On the iRIS 350FXV model, the second 8MB is used for audio file storage for up to two languages.

LED Indicators
A tri-colour LED is provided to indicate iRIS 350FX general status. A range of conditions may be determined through this innovative display. Eight other LED indicators allow diagnostics of I/O status and communications.

Connectors
Pluggable screw terminals fitted to the PCB provide all the connection points for the iRIS 350FX I/O and power supply. A DB9M connector is used for the main RS232 communications port. A standard SMA RF connector provides the antenna connection.

Enclosure
The case is constructed from die-cast aluminium alloy with a hard grey paint finished. A neoprene gasket provides the seal to achieve the IP67 rating. Cable entry is through a set of four compression glands on the base.

RS232 Port
One DTE configured RS232 communication port is provided for interfacing with laptops or suitably equipped serial data radios or external equipment.

Wireless 3G Modem
The iRIS 350FX is normally supplied with a high-performance wireless 3G modem (Sierra Wireless Q26Extreme). This enables high-speed data transfer virtually on demand. Extensive software options give flexibility and minimise data traffic.

Communications Option Board Adaptor
On later units (PCB Rev 1.2+), a secondary communications adaptor is provided. This accepts custom communication modules instead of the standard wireless 3G modem. Modules include Ethernet® and embedded satellite (Iridium 9602 SBD).

SDI-12 Interface
The integral SDI-12 interface fully complies with the SDI-12 electrical standard. The firmware support level is to SDI-12 V1.2.

4 x Digital I/O Channels
Four digital I/O channels are provided. Each channel may be configured as either an input or an output.

The **digital input** mode operates with either a clean-contact activation to 0V or else a dc input signal (min 3.6V, max 12V) referenced to 0V (GND).
The **digital output** modes may be selected for either a switched 12V output, or open-drain sinking to 0V. Both modes are limited to 100mA maximum.

4 x Analogue Inputs
The four analogue inputs are uni-polar, 16-bit resolution. Nine input ranges are provided, from 0-80mV to 0-5V. Inputs are protected to 30Vd.c. Current (e.g. 4-20mA) inputs are supported with internal 100Ω sink resistors.

1 x Analogue (Excitation) Output
A variable (selectable as 0-5V or 4-20mA) excitation output is provided to energise passive instruments such as potentiometer type wind vanes or alternatively to send a derived analogue signal to other equipment.

I/O Expansion Port (Hardware Revision V1.2+)
A "1-wire" I/O expansion port is available on later units (PCB Rev 1.2+) for future optional expansion I/O capability using third-party modules.

BASIC SPECIFICATION

- **SIZE:** 160mm x 130mm x 70mm (6.29in x 5.11in x 2.75in) (WxHxD)
- **MASS:** 1300g (2.86lb) including internal SLA battery.
- **POWER SUPPLY:** Internal and/or external 12V SLA battery. Lowest power mode current ~ 3mA. An integral charger accepts a 15-30Vdc input. A solar panel can be directly connected to the charger input. Over-voltage and reverse polarity protected with self-resetting fuse.
- **DATA STORAGE:** 8MB flash memory. A typical site with 2 parameters logged every 15 minutes plus battery voltage logged hourly will give almost 10 years of storage before data overwrite occurs.
- **COMMUNICATIONS:**
  - Non-isolated DTE RS232 at 1200 - 115200 bps (default 38400 bps)
  - Wireless 3G modem. Or, on PCB Rev 1.2+), a custom comms module.
  - SDI-12 instrumentation port.
  - Serial VGA camera proprietary connection (3.3V CMOS levels)
- **ENVIRONMENTAL:**
  Enclosure: IP67
  Operating: -10ºC to +70ºC (14 ºF to +158 ºF).
  Storage: -30ºC to +85ºC (-22 ºF to +185 ºF)

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Issue 3 – 20131204

Secure logger box

Montrose Electrical Boxes

Versatile Montrose Electrical boxes are cast aluminium multi-purpose strong boxes that have become famous for their appearance in almost every suburb of greater Auckland. More recently these boxes have been adapted and used for a variety of purposes. Freestanding (bolted to a plinth) or wall or post mounted, these boxes come in a wide range of sizes and formats. A selection of our standard boxes are shown below. There are also optional extras available, so call us to discuss your particular needs.

MK3 Box type

Detailed features PDF

Overall Dimensions (mm)

Box	Height	Width	Depth
MK 3/32	762	320	270
MK 3/58S	685	577	365
MK 3/58	940	577	365
MK 3/58L	1219	577	365
MK 3/76	628	228	228
MK 3/81	1219	812	371

Clear Working Space (mm)

(Panel size by max clear dimension to inside of door)

Box	Height	Width	Clear
MK 3/32	558	508	254
MK 3/58S	812	508	355
MK 3/58	914	508	355
MK 3/58L	914	508	355
MK 3/76	914	736	215
MK 3/81	1016	736	355

Fixing Grid for Hold-down Bolts (mm)

Box	Width	Depth
MK 3/32	247	127
MK 3/58S	485	203
MK 3/58	485	203
MK 3/58L	485	203
MK 3/76	692	79
MK 3/81	714	203