

SCADATRON TELEMETRY ST23 RTU (REMOTE TERMINAL UNIT)



**SCADATRON
TELEMETRY**



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1 INTRODUCTION



A Scadatron Telemetry ST23 Remote Terminal Unit when placed in a NEMA-4X Enclosure

The ST23 Remote Terminal Unit (RTU) is a Malaysia made micro-controller based intelligent and versatile measurement and control unit. The system is robust in design and compactly constructed to suit applications in harsh industrial environments.

The RTU is designed to be placed at remote hydrological station to monitor river water level and/or rainfall. The acquired measurement will be transferred in form of Short Messaging System (SMS) back to the Central Monitoring System (CMS) through GSM Mobile Network. The field measurement or status data is monitored by the RTU by its digital inputs or analog inputs. The digital inputs include door open security alarm, float-switches cut-in/cut-off levels or any other status obtained from transducers and switches. The RTU is capable of receive 4-channels of analog input in form of 4-20mA industrial standard current loop. Hence, the RTU can measure 4 analog measurement concurrently, such as water level, water quality such as turbidity, de-solve oxygen, chlorine, etc.

2 FEATURES

The ST23 RTU is designed for reliability and low power operation. It is equipped with most of common feature required for remote data monitoring as well as data logging. The following is the summary of its features:

- Single Board Design for easy Operation & Maintenance
- Industrial Grade 68HC11 based micro-controller for reliable operation
- User friendly user interface through 4x4 matrix keypad and 2rows x 20 column Liquid Crystal Display (LCD) interface.
- Large non-volatile RAM memory (128 Kbyte) as ring type buffer for data logging, able to Time-Stamp and Log Data internally up to a period of minimum 4 months when 15 minutes data logging is utilized. The non-volatile memory able to store data for minimum 10 years without external power
- Upgradable software flexibility using removable EPROM. Program memory never corrupted due to internal interruption
- Year 2000 compliant Real-time clock with 10 years battery backup without external power
- All system parameters such as serial number are store in non-volatile memory (EEPROM) inside the micro-controller
- 3 channels of Isolated digital input for monitoring of digital alarm
- 16 channels of high impedance digital inputs or connection to Analog-To Digital type Shaft Encoder in Float-And-Counterweight water level sensor
- 2 channels of volt-free digital output (240V 1A each), use external interposing relay for flood warning siren control, pump control, etc.
- 2 channels of high-speed pulse input accept contact closure signal or 5V-13V DC voltage, user configurable for opto-isolation provide flexibility in connection and for interface to all type of sensors for event logging such as tipping bucket type rain gauge. Pulse input equipped with efficient hardware filtering to eliminate faults multiple rainfall event record due to poor tipping bucket contact (settable for no filtering, 2 pulse/second or 1 pulse/second)
- 4 channels of high accuracy differential/ single-ended analogue inputs with Instrument Operations Amplifier (0-20mA, 4-20mA, 0-5V, 0-10V).
- Built in watchdog circuitry, RTU never hang
- Removable terminal block to ease maintenance work
- Power surge protection by using Metal Oxide Varistor (MOV) and Suppression Diode on supply and digital input
- Low power consumption, overall power consumption is less then 1m-Ampere Hour (AH) good for long terms operation without charging or battery change, able to operate more then 1 years on 24AH maintenance free battery
- Wide range AC (12V-24V AC) or DC (8V-30V DC) supply input
- IP65 rating aluminum die-casting enclosure allow the use of vandalism-proof screws for reliable operation in tropical and harsh environment
- Rugged Operating Limits with wide operating temperature range from 0°C to 70°C, 0 to 95% relative humidity, non-condensing
- Logged data able to be retrieved at site using portable reader such as Pocket PC, Mini-Retriever Unit or by using a laptop computer
- Allow set of same data to be downloaded using portable retriever (selection using Poll ID 1, Poll ID 2, Poll ID 3 or Poll ID 4).
- Data retrieving software provided free for installation on laptop computer for downloading data at site if required
- Ability to accept Control Commands through GSM Data mode or SMS and response to user's request for data using SMS or "Missed Call"

- Ability to initiate communication for Alarm Reporting
- Ready software driver for support all type of communication equipment inclusive of SMS via GSM Modem, GSM data Calls, UHF/VHF Radio, PSTN MODEM or leased line by having separate communication equipment



Diagram above shows some of the sensor instrument and communication equipment able to connect to ST23 RTU

3 SPECIFICATION

Processor And Memory	
CPU Type	Motorola MC68HC11 micro-controller
CPU Speed	7.3728MHz
RAM	32K standard CMOS static RAM 128K non-volatile static RAM for Data Logging backup by on-chip lithium battery for more then 10 years without external power
EPROM	Standard 64K CMOS Flash type EPROM
EEPROM	512 bytes non-volatile memory for storing system parameters
Real Time Clock	CMOS Clock & Calendar, backup by on-chip lithium battery for more then 10-years without external power Data format: sec/min/hour/weekday/day/month/year
LCD display	2 rows x 20 characters Liquid Crystal Display (LCD)
Keypad	4 x 4 matrix, heavy duty type
Serial Communication Port	
Usage	For GSM /SMS Modem, PSTN MODEM, portable data retriever interrogation / programming
Interface	RS232C
Data length	8 data bits
Data Parity	None
Baud Rate	50,300,600,1200,2400,4800,9600,19200 baud programmable
Connector type	DE-9 male with retention screws (DTE)
LED indicators	TXD, RXD, RTS
Input/Output	
Digital input	3 channels opto-isolated input points (5V-30V)
Digital input	16 channels high impedance digital input points
Digital output	2 volt-free contact outputs, rating 240V 1A each.
Analog input	4 differential analog input channels, input range 0-20mA/4-20mA/0-5V/0-10V. External 200ohm 1% series resistor. High accuracy A to D converter, 12 bit resolution. Equipped with moving average routine for error-free analog reading
Pulse input Counter	2 channels, maximum response 1 KHz Opto-coupler isolation of each channel provided. With hardware filtering circuitry to eliminate double - pulse
Fail Safe Features/Supervisory Circuitry	
Watchdog timer 1	External watchdog timer with 1.6S time-out period
Watchdog timer 2	An MCU internal watchdog timer system
Power Supply Section	
Supply	8- 30V DC / AC unregulated supply
Over-voltage protection	MOV varistor on unregulated supply voltage and 6.7V zener diode on regulated 5V supply
Battery backup	CR3032 3V Lithium battery to backup RAM
Power consumption	Typical 60mA (on 12VDC) in active mode, less then 1mA in idle mode
Internal battery backup	CR2032, 3V 220mAH Lithium battery to backup basic RAM and MCU internal memory when external dry-cell battery is removed or

	replaced Not consumed when dry-cell battery is connected, able to operate minimum 2 years without external supply
Indicators	
Power supply status	Power on LED
Digital input status	3 LEDs indicator for 3 points isolated digital inputs
Digital output status	2 LEDs indicators for 2 volt-free contact output
Pulse Input status	2 LEDs indicators for 2 pulse input points
Communication status	3 LEDs indicators TXD,RXD, RTS
Enclosure	
CPU Enclosure	IP65 Aluminum die-casting with epoxy paint Dimension: 270mmH x 132mmW x 93mmD
Weatherproof Enclosure	NEMA-4X fiber-glass enclosure with lockable hinged door Dimension: 16"H x 17.87"W x 8.74"D
System Parameter And Settings	
RTU Identification	Settable from 1 to 255 stored in EEPROM
Network Identification	Settable from 1 to 255 stored in EEPROM
Serial Number	8 digit number stored in EEPROM
Date/time	Settable Date/ Time using keypad/LCD
Four set of Poll ID	Four set of pointer with separate poll ID (settable in portable retriever) allow same set of logged data to be retrieved by 4 different set of Master/sub-master
High-speed Counter	settable counter value using keypad/LCD
Set factory default	User may set RTU settings to factory default by using password protection option
Logging Interval	User settable Logging Interval settable from 1 seconds, 1 minute to 1440 minutes, log 4 measurement concurrently base on time
Log Parameters Setting	Allow to select 4 logging parameters selectable from any of the analog inputs, digital inputs, or pulse counters
Event Logging	Able to log event based on any of the two pulse inputs, any of the 16+3 digital inputs to record the exact date/and time of the event occurrence accurate to every seconds
Start / Stop Logging	Allow user to start/stop logging manually
Autodump Interval	User settable Automatic Report Interval (report to Master) settable from 1 seconds, 1 minute to 1440 minutes
Debouncing	User settable analog and digital de-bouncing count to eliminate error in input
Analog Settings	Allow user to set Analog Measurement parameters such as High Range (correspond to 20mA), 4mA and 20mA offset for calibration and base offset (engineering reading at 0mA)
Digital Output Settings	Allow settings of digital output format to be momentary (pulse on for 1..30 seconds) or to be permanent On/Off
Analog Alarm Settings	Allow user to set Analog Alarm threshold such as Low-Low, Low, High, High-High for alarm reporting use
Pulse Rate Alarm Settings	Allow setting of 3 levels of pulse rate alarm such as 50pulse/hour, 80pulse/hour, 120 pulse/hour
Serial Settings	All serial port parameters are settable such as baud rate, number of stops bits and parity type (even, odd, none)

GSM Settings	Allow all type of SMS related settings such as GSM network provider – 0 for MAXIS, 1 for CELCOM, 2 for DIGI1800,3 for TMTOUCH and 4 for TIME CELL.
GMS Information	Allow user to view GSM status such as GSM cellular network signal strength and current GSM activity on LCD
SMS Users	Allow storage of minimum 20 user with mobile number in RTU memory, user's mobile number editable/add-able/ removable using SMS with password protection
Database View	Allow user to view all measurement such as Analog Input channel 1..4 in raw value and engineering value, Digital Input in Binary and HEX display, Pulse Input counters value, Battery Voltage
Check Battery Voltage	Automatic checking for external and internal battery low at all time and indicate battery low by giving warning. Battery voltage is transfer to Master every time RTU is interrogated
Instrumentation Interface (example only)	
Water Level Gauge	Hydrostatic / Ultrasonic Level Sensor, Flow meter, Pressure Snesor
Transducer	4-20mA transmitter
Range	0 - 99.99m (water depth) or base offset + (0 - 99.99m)
Resolution	0.1 cm for 5m range
Accuracy	12 bit resolution, +/- 1LSB linearity
Interface	0-20mA/4-20mA differential input (200ohm 1% series resistor)
Local data view	Yes, converted to engineering data on LCD display
Data logging	Yes, up to 4 channels with date & time stamping
Number of channel	4 channels on-board
Other feature	4mA offset and 20mA offset for calibration, Moving average algorithm for stable and error-free reading
Water Level Gauge	Counterbalanced Float
Transducer	Analogue-to-Digital Shaft encoder
Range	00.00 - 99.99meters
Resolution	1 cm (optional 1mm)
Accuracy	1 cm (optional 1mm)
Interface	1 TTL channel (16-bits) and 1 opto-isolated channel (16 bits)
Local data view	Yes, on LCD display
Data logging	Yes, 1 or 2 channels with date & time stamping
Number of channel	1 channel on-board
Flow Counter	Flowmeter Output (M3/S)
Transducer	5-30V volt input or contact closure
Range	normal 0 – 999,999 count (maximum 4,294,967,295)
Unit	1x M3/S, 10x M3/S or 100x M3/S
Speed	10Hz..1Hz if filtering enabled (Maximum 1 KHz)
Interface	opto-isolated pulse input / accumulator
Local data view	Yes, counter viewable on LCD display
Event logging	Possible, 1 or 2 channels with date & time stamping
Number of channel	2 channel on-board
Rain Gauge	Tipping bucket type rain gauge
Transducer	Reed switch contact closure
Range	0 – 99999mm
Resolution	0.5mm (optional 1 mm)

Accuracy	0.5mm
Interface	opto-isolated pulse input / accumulator
Local data view	Yes, on LCD display
Data logging	Yes, 1 or 2 channels with date & time stamping
Number of channel	2 channel on-board
Other feature	Accumulative rainfall set locally or transfer from master

4 ST23 RTU ADVANTAGE

- ST23 is a compact / embedded *single board controller card* which ease the work of trouble-shooting and maintenance.
- ST23 has *direct connection* to GSM MODEM of all brand (Wavecom, Siemen, etc.)
- ST23 support latest data *request through Missed Call beside SMS request* (User no need to pay for the request SMS, only the reply data is chargeable)
- ST23 support *direct alarm reporting to maximum 20 users, no congestion of alarm pending to send from Master Station*
- ST23 can provide *direct connection* to satellite equipment (INMARSAT-C / ACESat) It can be *installed anywhere in the world!*
- ST23 has its pulse capturing algorithm to give a fast and accurate pulse input, *no erroneous pulses*
- ST23 has *smart & accurate* analogue input algorithm with Moving Average to give a stable and accurate 4-20mA output conversion
- ST23 comes with a standard set of keypad and LCD interface for *user friendly interface*
- ST23 has integrated *data logging facilities* which can store up to 12 months data based on 1 hour interval (based on 4 parameters with date & time stamp)
- ST23 has flexible communication configuration include store-and-forward (SAF), *RMU can act as a repeater!*
- The ST23 has very *low power consumption* specially designed for solar powered or battery only operation
- The ST23 RTU is *designed for harsh environment* which minimise the use of connectors and plug in circuit board
- Application software embedded in the ST23 runs under a powerful and *fast real-time multitasking operating system*. Modification on RTU's operation can be done in days by our local programmer
- It is *Year 2000 compliance*
- The ST23 is the *4th generation RTU by the manufacturer* with data logging facilities, it is free of hardware design fault and software error
- ST23 RTU is Malaysia design and make by a MSC status company, high quality and low in price!
- The manufacturer guarantee the spare parts availability is 10 years in Malaysia

5 SPECIFICATION HIGHLIGHT

5.1 MICROCONTROLLER BASE CPU

The ST23 CPU has employed an Industrial Standard Microcontroller Based System (Motorola MC68HC111) designed specially for low power consumption from a large, reputable manufacturer.

Industrial Microcontroller shall be preferred over desktop PC microprocessors as they have a longer manufacturer support life span. The micro-controller used shall be available off-the-shelf from Malaysia market without proprietary software or firmware embedded.

5.2 DUAL WATCHDOG TIMERS

Dual Watchdog Timers are provided to automatically reset the system in the event of system software or hardware failures. The 1st watchdog timer generates a soft internal reset of the CPU and has a time-out of less than that of the 2nd. The 2nd watchdog timer are configured to provide a hard external reset of the CPU.

5.3 REAL-TIME CALENDAR CLOCK WITH AT LEAST 10-YEARS DATA RETENTION

A Real-Time Clock/Calendar (RTC) has been provided to keep accurate time and date information of events. The clock employed allows synchronization to external time signals provided by the Centre Monitoring Station or from the GSM network. The RTC has an internal, battery-backed RAM capable of retaining data for 10 years without external power. The Real-Time Clock is Year 2000 compliant.

5.4 INPUT AND OUTPUTS

The ST23 onboard signal allowance shall be: -

Analogue Inputs	4 channels (for water level, pipe flow, pipe pressure, etc.)
Isolated Digital Input	3 channels opto-isolated wide-voltage digital input (security, float switches if any, TNB failed, etc.)
Normal Digital Input	16 channels (connection to Float-And-Counterweight water level sensor)
Digital Output	2 channels (On/Off pump, communication equipment, siren)
Cumulative Pulse Input	2 channels (rainfall input, cumulate pipe flow volume)

The SMS Remote Terminal Unit (RTU) Controller ST23 consists of onboard Digital and Analogue Input with the ability to be connected to most of the market available sensors with Digital or Analogue interface.

Analogue Input provides/accepts Differential 0 to 20mA or 4 to 20mA Current Loops. The Input Impedance is 1M ohm minimum on any voltage channel and maximum of 250 ohm on any current channels. The resolution of A to D converter is 12 bits with an accuracy better than +/- 0.5% of the Full Scale Output over a temperature range of 0 ° to 50 ° C.

Each Analogue Input has Independent Programmable 4mA and 20mA Offset used for factory calibration.

3 channels of Digital Inputs are Optically Isolated with an isolation of at least 4kVAC/sec for surge protection. Digital Inputs are configurable as Pulse, Status (N.O./N.C.) or Control Signals.

The ST23 RTU is also equipped with 16-points of high-impedance Digital Inputs (DI) which is compatible to TTL levels and another 16-points opto-isolated Digital Inputs (DI). The Digital input, which may accept dry contacts (no voltage) or other electric signals with wide voltage range (5V,12V or 24V signals). The 16 points Digital inputs can be grouped into one digital input channel with 16-bits/4-digit which is needed for float and counter-weight type water level sensor (shaft encoder). Each Digital Input is software filtered using "Digital Input Debounce" setting to avoid erroneous reading during signal transition period.

Two (2) volt-free digital outputs is allocated for control pump On/ Off or for activation of local siren /or other communication equipment. The contact rating is 1A 240VAC.

5.5 REAL TIME DATA AND DATA LOGGING

Data Acquisition can be divided into two broad classifications – Real Time data acquisition and Data Logging. Remote Terminal Unit (RTU) normally related to Real Time data acquisition is when data acquired from sensors is used either immediately or within a short period of time, such as when controlling a process. Normally real time data is tagged with date/time at Master Station.

Data Logging is a method of data acquisition when data acquired from sensors is stored in memory for later use. Data Logger measure sensors at a specific scan rate, process data, store the data in final storage, and initiate telecommunications or waiting for retrieve activity. Normally all logged data is tagged with date/time either directly or indirectly.

The ST23 RTU controller is designed with both real-time data acquisition and data logging features. Up to four (4) sensor parameters can be logged into each record with the date and time stamp for the data.

The RTU data logging facilities is very flexible and include the following data logging mode:

- Time Base Data Logging such as record of all sensor readings in every 15 minutes interval (settable from 1 second to 24 hours)
- Status Change Event Logging are also logged. These events logged are, any changed/toggle of the 16 point digital Input or 3 opto-isolated digital inputs
- Alarm Event Logging such as alarm due to sensor threshold alarms
- Pulse Input Event Logging such as record of every pulse from rain gauge, flow meter or hour run meter
- System Events Logging such as RTU hardware Reset, user start logging and stop logging operations

The ST23 Controller utilizes a 128KByte non-volatile memory for storing the logged alarm event or time triggered logged data complete with event timestamp (up to every second)

which is normally set to 15 minutes interval. The data logged can be easily configured to monitor of any changes of state on every pulse input, 16 points alarm input.

The storage capacity of these alarm or events in the ST23 controller without retrieve is 8,704 records. If the RTU is set to log data once an hour, it is able to store 362 day's data without being retrieved.

For time triggered data logging such as water level data logging, the logging interval is user settable from the ST23 controller and ranges from 1 seconds, 1 minutes to 24 hours. The time triggered data logging can be manually stopped or restarted by the user at any time through the keypad and LCD.

All logged data will be transferred to the Central Monitoring Station (CMS) in compressed mode (PDU SMS format) upon "Auto-Dump Interval" which is normally set to 12 hours (settable from every hour to every day). Another three sets of same data is reserved for retrieved by another 3 sets of sub-master or Portable Data Retriever Unit. The Portable Data Retriever Unit can be a pocket PC with serial port or any IBM compatible laptop running a data retrieval software.

The RTU can be programmed to automatically dump logged data by using SMS to the Central Monitoring Station (CMS) every 12 hours or any preset interval set in the "Auto-dump" interval parameter.

Real time data can be retrieved by using SMS commands with Password protection or simply by issue a call to the RTU mobile number, this function is called "Missed Call". Upon receive the request command, the RTU will reply the latest data in the RTU memory the Caller.

5.6 ALARM REPORTING BY EXCEPTION

The ST23 is capable of Automatic Alarm Reporting when there is an alarm, independent of any preset Reporting Interval. The alarm will be reported in form of SMS to the Central Monitoring System (CMS) as well as any pre-programmed mobile phone numbers (maximum 20 numbers).

The RTU is designed to monitor three (3) opto-isolated digital input or sixteen (16) normal digital input. The isolated digital or alarm input section is isolated by opto-coupler for reliable operation. Any of the Alarm points can be programmed to be selected to be in operation or not in operation. Hardware de-bouncing feature is done by the micro-controller to eliminate faults alarm due to bad line quality.

Each Analogue input channel will be assigned a minimum of three (3) Alarm Limits (Alertm, Waning, Danger). If an Analogue value transgresses one of these limits, an ALARM PRESENT condition will be signaled. If the value later recedes from the limit, an ALARM CLEARED condition will be signaled.

Analogue Inputs will be allocated a dead band below each alarm limits (causing the appropriate alarm actions to be initiated), the signal is allowed to oscillate within the dead band without causing further action. This prevents the generation of spurious alarm messages

when the signal level is closed to the alarm limit. The dead band will be expressed as a percentage of the limit. Each individual Analogue contains its own dead band adjustment value and adjustable between 0% to 50% of full scale value.

Digital and Analogue Signals are assigned a Definable Time dead band adjustable between 0 and 300 seconds.

Pulse input channel is assigned a minimum of three (3) Alarm Limit (Alert, Warning and Danger) based on the pulse rate per hour. If any the cumulated pulse value transgresses one of these limits, an ALARM PRESENT condition will be signaled. If the value later recedes from the limit, an ALARM CLEARED condition will be signaled.

5.7 ABILITY TO ACCEPT REQUEST / POLLING DATA COMMANDS

The ST23 is capable of receiving user-initiated SMS, transmitted from maintenance personnel mobile phone, to request for Real-time Hydrological Data. The command SMS is password protected to prevent unauthorized personnel from requesting the SMS data, which may cause the RTU mobile phone bill to be high.

Real time data can also be retrieved by simply by issue a call to the RTU mobile number, the RTU will drop the call without answer to it to avoid any Call Charges. This function is called "Missed Call". Upon receive the request command, the RTU will reply the latest data in the RTU memory the Caller.

5.8 ABILITY TO ACCEPT CONTROL COMMANDS

The ST23 is capable of receiving user-initiated or automatic control command signals, transmitted from the CMS or another RTU, to actuate external device such as pump control, warning sirens, or control valve when is required later. The ST23 installed at the hydrological station can be programmed to send control commands in form of SMS straight to another ST23 installed in a Flood Warning Siren Station to operating the Siren remotely.

Any transmitted commands signal will be sent immediately, independent of any preset communications interval.

5.9 COMMUNICATION AND STATUS INDICATORS

The ST23 has multiple communications channels with the following minimum features:

- i. One RS-232 serial channel for data retrieving purposes
- ii. RS232C ports suitable for GSM MODEM interface, PSTN MODEM, Radio MODEM or Satellite Transceiver Interface.

The ST23 has LED status indicators for Transmit, Receive, RTS (Ready To Send) which is essential for communication system trouble-shooting. The LED status is able to be turned OFF or ON through a master control LED Status Enable Push Button for power saving purposes.

5.10 RUGGED OPERATING LIMITS

The ST23 is designed for unattended operation in harsh environments with an operating temperature range of 0°C to +65°C and 95% non-condensing relative humidity.

Calculated Mean Time Before Failure (MTBF) for the ST23 is at least 10,000 hours of continuous operation.

All ST23 RTU program is stored in the form of non-volatile format without the need of battery backup such as EEPROM (Electrical Erasable Programmable Read Only Memory). Lost of RTU power or changes of RTU backup battery will not cause RTU mul-function due to program lost.

The ST23 RTU's components and printed circuit boards is tested and burnt-in in factory before deliver. It is rugged construction and designed with adequate safety margin to withstand continuous service with a minimum of maintenance.

The ST23 RTU's component or assembly is capable of replacement by one of an equivalent type, the characteristics of which fall within the limits of tolerance, without affecting the performance, reliability, and stability of the system. All components is readily accessible and items such as relays, switches and contractors shall be removable without having to remove other components.

The ST23 RTU's is designed and constructed to give a minimum operational life of 10 years continuous service when operated on a 24 hours, 365 days per year basis. The manufacturer provide guarantee for spare parts availability for a period of ten (10) years.

All internal wiring in the RTU is of adequate size and rating, neatly arranged and installed, for easy carrying out of normal operations. All wiring and cabling is neatly terminated to give good mechanical and electrical connection such that inductive interference is reduced to a minimum.

5.11 LOW POWER CONSUMPTION

The ST23 is micro-controller based, CMOS and Zero-Power Programmable Logic Array (PLA/GAL) circuitry is used whenever possible to minimize power consumption.

The ST23 Controller equipment is designed for continuous operation on nominal 12V or 24V DC/AC power source. It can take wide range supply range from 8V to 30V DC operations. When 230 V AC power source is available, a step down transformer is necessary for convert the 230V AC to 12V AC or 24V AC before connected into the RTU.

The Controller is designed with minimum power consumption, which is less than 60mA in active mode and less than 1mA in idle mode for achieve long terms reliable operation using 12V maintenance free battery .

The ST23 Controller is capable of monitoring the incoming power supply voltage. It is able to automatically recover from a power loss condition without affecting the operation.

5.12 CONFIGURATION PROGRAM AND PORTABLE DATA RETRIEVER

The ST23 Controller is user configurable at site through the RTU's a user-friendly menu driven interface by using it's keypad and LCD display. The ST23 is also configurable at site using a Portable Data Retriever or remotely using SMS.

Logged data in the RTU can be retrieved in the field by using a serial cable the RS232C port of the logger to a Portable Data Retrieving Unit or laptop computer running user friendly data retrieval software.

Windows based data retrieval software is provided free by the manufacturer. The retrieved data is saved in Microsoft Access database file format and can be easily export to Comma Separated Variable (CSV) file format.

5.13 PROTECTION AGAINST LIGHTNING SURGE

Equipment deployed externally in the Malaysian environment may encounter lightning surge problems during heavy thunderstorms. The ST23 RTU is designed with lightning surge protection on the signal input line and power supply input.

5.14 SOURCE OF EQUIPMENT

The ST23 RTU is designed and made in Malaysia by a MSC Status company. Manufacturer guarantee full support to ensure the RTU downtime and turnaround time can keep to a minimum due to faster technical or after sales support.

The RTU manufacturer guarantee that the spares of RTU available in West Malaysia for the next ten (10) years after the expiry of the warranty period. A letter from the RTU manufacturer guarantee on the above matter is attached in this proposal.

The RTU employ open architecture in hardware design so that component replacement can be done easily without depends only on the manufacturer. Component or assembly is capable of replacement by one of an equivalent type, the characteristics of which fall within the limits of tolerance, without affecting the performance, reliability, and stability of the system.

6 ST23 RTU PHOTO GALLERY



Internal view of ST23 RTU



External view of ST23 RTU with a typical ultrasonic water level transmitter

7 ST23 RTU SMS COMMUNICATION MODES

The communication protocol proposed utilize Short Messaging System (SMS). Full SMS software driver is installed in the RTU which define how the RTU shall send SMS through the GSM MODEM to the Central Monitoring Station (CMS) and / or mobile phone.

The ST23 support six (6) types of SMS communication modes as follows:

- RTU automatic report logged data to CMS
- RTU dump all logged data upon request from CMS
- RTU automatic report alarm to CMS
- RTU automatic report alarm to operators' mobile phone
- RTU automatic report alarm/command to another RTU for pump control
- RTU reply real-time data upon request from mobile phone

7.1 RTU AUTOMATIC REPORT LOGGED DATA TO CMS

1. In this mode of operation, the RTU begin and end transmission. When the "Auto-Dump Interval" which is specified in minutes matches the RTU clock, the RTU shall dump all the logged data in it's memory to the CMS GSM MODEM number stored in it's memory. For example, if the "AutoDump Interval" is 720 minutes and the "Log Interval" is 15 minutes, the RTU will dump all the logged data (4 x 12 hours = 48 data) in one SMS back to the CMS.
2. The data in SMS is compressed and send in PDU format from the RTU, it may consists of maximum 48 measurement such as water level. If the number of data need to be sent can not fit into one SMS, it will be separated in two or more SMS and to be sent in sequence to the CMS.
3. Once the logged data has been retrieved and send to the CMS, it will not be repeated in the next data dump. Any how, the old data can still be retrieved by the same CMS server if the Polling Identification (ID) set in the CMS Server software be changed from 1 to 2,3 or 4. A total of 4 set of memory data pointers is allocated in the RTU to allow for multiple data reporting mechanism if more then one CMS Server is needed.
4. For secondary CMS which may wish to obtain a similar set of logged data from the RTU, the data retrieve mechanism is by sending a "Polling All Log" commands SMS to the RTU with an ID of 2. The RTU will then reply a multiple numbers of SMS back to the requester CMS with data pointer of number 2.
5. The operations above is similar for transmission rainfall event data to CMS except that each SMS is able to send 68 tips of rainfall event or 34 mm rainfall data.

7.2 RTU DUMP ALL LOGGED DATA UPON REQUEST FROM CMS

1. The ST23 support automatic logged data reporting to one CMS GSM MODEM number stored in it's memory by default. This default CMS is tagged with Identification Number (ID) No 1.
2. If the operator in the CMS need to get the update hydrological data at that particular moment without need to wait until the next data dump interval, A "Polling All Log" commands SMS can be send to the RTU with appropriate ID number. The RTU will then reply all the logged data since the last report to the requesting CMS.
3. The operations above is similar for transmission rainfall event data to CMS.

7.3 RTU AUTOMATIC REPORT ALARM TO CMS

1. In this mode of operation, the RTU begin and end transmission. Whenever an alarm is detected from the RTU such as water level Alert/Warning/Danger, Rainfall Intensity Alarm such as 50mm/hour, 60mm/hour, 100mm/hour or even RTU door opened security alarm; the RTU immediately dump the alarm message to the CMS GSM MODEM numbers stored in it's memory.
2. The exact date and time of when the alarm occurred is logged and reported in the Alarm SMS.
3. When the alarm have being received by the CMS, the CMS shall process the alarm by display it on the alarm page, insert into database and broadcast the SMS to a list of maintenance personnel (maximum 20 users) responsible for that particular RTU based on a time table. The scheduler or SMS List can be easily updated by the authorized operator by key-in to the time table.

7.4 RTU AUTOMATIC REPORT ALARM TO OPERATOR MOBILE PHONE

1. The ST23 RTU actually support direct alarm reporting to a numbers of maintenance personnel's mobile phone numbers which is stored in the RTU's memory
2. Similar to the mode mentioned above. Whenever an alarm is detected from the RTU such as water level Alert/Warning/Danger, Rainfall Intensity Alarm such as 50mm/hour, 60mm/hour, 100mm/hour or even RTU door opened security alarm; the RTU immediately dump the alarm message to a number of Mobile phone numbers in it's memory
3. The exact date and time of when the alarm occurred is logged and reported in the Alarm SMS.
4. The alarm reporting mobile phone list can be added or removed remotely by sending a SMS commands from any mobile phone to the RTU with an authorization password.

7.5 RTU AUTOMATIC REPORT ALARM/COMMAND TO ANOTHER RTU FOR SIREN CONTROL

1. The ST23 RTU can also support direct alarm reporting such as water level Alert/Warning/Danger, Rainfall Intensity Alarm such as 50mm/hour, 60mm/hour, 100mm/hour to another ST23 RTU GSM MODEM number which is located in Flood Warning Siren Station (FWSS).
2. These alarm signals received by the FWSS RTU, can be used to start /stop Flood Warning Siren automatically.

7.6 RTU REPLY REAL-TIME DATA UPON REQUEST FROM MOBILE PHONE

1. Each RTU can be configured to allow any officer or operator to request for latest water level and/or rainfall data by sending a request SMS to the targeted RTU. The sample Request SMS can be "#9999, Poll" where 9999 is the authorization password. Once received this request command, the RTU will reply the latest water level, daily maximum level and daily minimum level to the requesting phone number. A separate SMS will be used to send latest rainfall data such as rainfall for the past 1 hour, past 2 hour and past 3 hours.

2. To prevent anonymous user to request for data, the ST23 can also be configured to responds to only to a maximum of 20 officers or operators, whose mobile number is recorded in the memory of ST23's RTU, to request for latest data.
3. Real time data can also be retrieved by any user simply by issue a call to the RTU mobile number, the RTU will drop the call without answer the call to avoid Call Charges. This function is called "Missed Call". Upon receive the request command, the RTU will reply the latest data in the RTU memory the Caller.
4. To prevent anonymous user to call in to the RTU, the ST23 can be configured to responds "Missed Call" only to the officers or operators, whose mobile number is recorded in the memory of ST23's RTU