Fact Sheet No: 29/11

MINI*pack* CTD-F

Compact, Smart™ based multi-parameter monitoring system for oceanography and limnology

MINI*pack* is a low cost, compact, robust and fully integrated CTD-F sensor suite designed to meet the demands of open ocean, estuarine and fresh water environmental monitoring, incorporating a 24 channel data logger.

MINI*pack* is designed to be a multi-parameter sensor data logger than can be deployed individually or at the core of a larger multi-parameter system. As such, it may be used as discrete profiling instrument, installed on a data buoy, moored in the ocean or to form the core of a towed undulating vehicle system.

OVERVIEW

MINI*pack* is the latest evolution of the highly successful AQUA*pack*. MINI*pack* is one-third the size of the AQUA*pack*, with greater versatility and increased memory capacity. It is a low cost, compact, robust and fully integrated conductivity, temperature, depth and fluorimeter measuring system. It is designed to meet the demands of open ocean, estuarine and fresh water environmental monitoring. It incorporates a high performance 24-channel data logging and transmission system, monitoring the integral CTDF sensors and any auxiliary instruments. MINI*pack* is highly versatile and there are a number of different determinants (see optical specification table). Each application uses an LED light source but requires a unique set of light filters in both the excitation and detection paths. The configuration is factory set by the selection of optical filters and spacers.

MINI*pack* is designed to be mounted on a towed vehicle such as the Chelsea AQUA*shuttle*, Nν-Shuttle or SeaSoar - deployed on buoys, on a mooring, or as the core of a profiling system. It can be operated to depths of 600 metres from dedicated oceanographic research vessels or ships of opportunity.

MINI*pack* has been designed specifically for easy installation into Chelsea's range of towed vehicles.

MINI*pack* may be used in a pre programmed stand-alone mode, powered from its internal battery with data stored in onboard memory. For real time applications, the MINI*pack* is provided with a transmission system with the capability of providing power to and acquiring data from up to 16 external sensors (14 differential channels & 2 single ended channels). These may typically include dissolved oxygen, pH, PAR, up and downwelling sensors, fluorimeters and transmissometers.

The highly versatile SmartMedia™ is used for pre-programming and storing of measured data. This data is easily extracted by a PC and presents data in ASCII files in engineering units that are easily processed by propriety software packages. Data may be stored on the internal SmartMedia™ Card (for standalone mode) or transmitted in real-time up the cable using RS422 (RS232 option) format. An interface unit is available to convert RS422 (or RS232) for onward transmission to a PC when long cables are required. A user-friendly Windows based GUI enables error free programming of the internal logger and data extraction.

SPECIFICATION

Size	114 mm dia. x 200mm (sensors to end caps)
Weight	3.25 kg (in air); 1.8 kg (in water)
Depth Rating	600m
Housing Material	Titanium / Acetyl
External Input	
via interface unit	18-72 VDC
via external battery pack	10-15 VDC
Logger Capacity	16Mbyte
Number of readings	100K across all channels
Number of channels	24
Interface Type	RS422 (RS232 option)
Data rate	9600 baud
Scanning rate	1Hz to 1 sample/day

Sensors	Type	Range	Accuracy	Resolution
Temperature	Pt resistance	-2 to +35^{O}C	0.003^{O}C	0.0005^{O}C
Conductivity	Induction Cell	0-70mmho/cm	0.005mmho/cm	0.001mmho/cm
Pressure	Strain Gauge with temp. compensation	0-600 dbar	0.2 dbar	0.01 dbar

Optical

	Chlorophyll a	Chlorophyll a	Rhodamine	Amido Rhodamine	Fluorescein
Excitation wavelengths	430/30 nm	470/30 nm	470/30 nm	425/30 nm	480/80 nm
Emission wavelength	685/30 nm	685/30 nm	590/45 nm	550/30 nm	530/30 nm
Concentration range	0.03-100 µg/l	0.03-100 µg/l	0.03-100 µg/l	0.04-200 µg/l	0.03-100 µg/l
Resolution	0.01 µg/l	0.01 µg/l	0.01 µg/l	0.025 µg/l	0.01 µg/l
Calibration standard:	Chlorophyll-a in acetone	Chlorophyll-a in acetone			

	Nephelometer	Phycoerythrin	Phycocyanin
Excitation wavelengths	*470/30 nm	530/30 nm	590/35 nm
Emission wavelength	*470/30 nm	580/30 nm	645/35 nm
Concentration range	*0.04-100 FTU	0.03-100 µg/l	0.03-100 µg/l
Resolution	*0.01 FTU	0.01 µg/l	0.01 µg/l

*the wavelengths for the turbidity filters are a customer option but must be in the range 400 to 700 nm. Also, the same wavelength is used in both the excitation path and the emission path.

TECHNICAL DESCRIPTION

There are two basic configurations of the MINI*pack*, Real-time and Standalone. The difference lies in the associated end caps. The MINI*pack* can be powered from its internal battery pack or an external battery pack, Chelsea Technologies Group's Portable Interface Unit or from the mains powered Standard Interface Unit. Battery life is dependent on acquisition time and the external sensor load connected.

Real-time Configuration

The end can be provided with the following connectors:

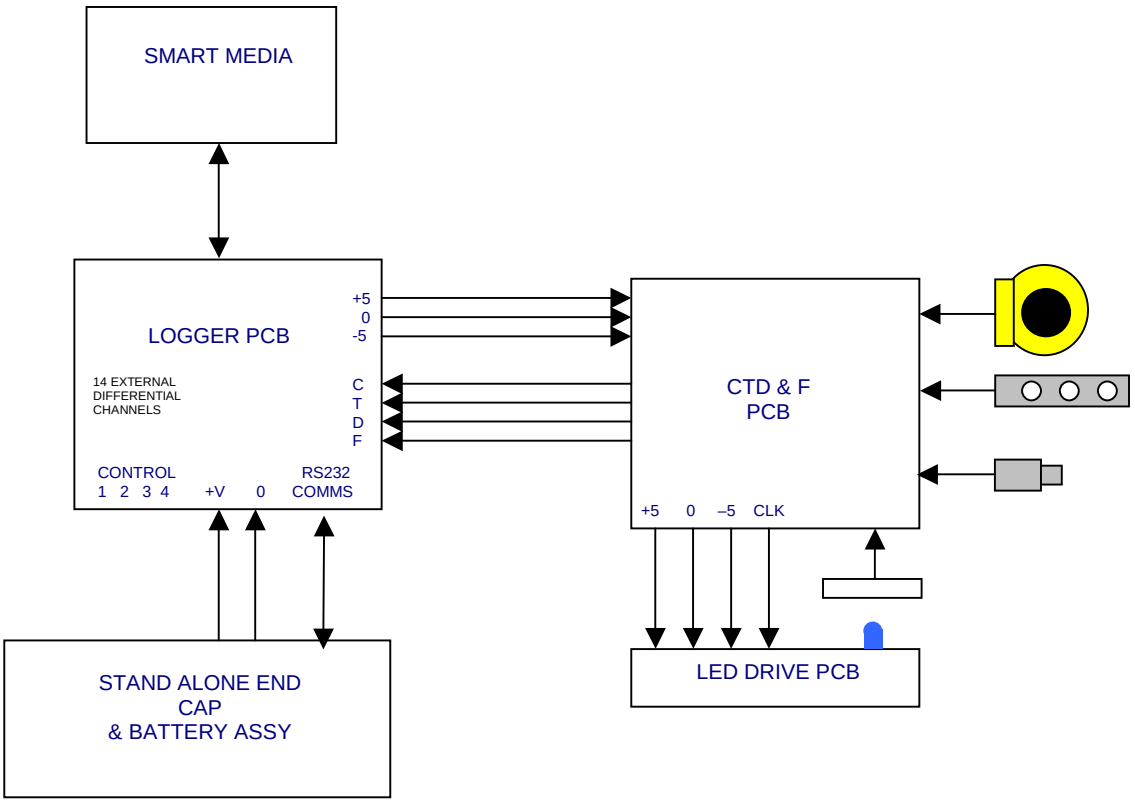
Connector	Use
MCBH16F Micro 16 Female connectors (1 off standard, 1 off optional)	Differential Channels for external sensors. (7 standard, 14 with option)
MCBH8M Micro 8 Male connector	Power & RS422 (RS232 option) Comm's
MCBH4F Micro 6 Female connector – **Option**	Switched Power & 2 single ended channels

Standalone Configuration

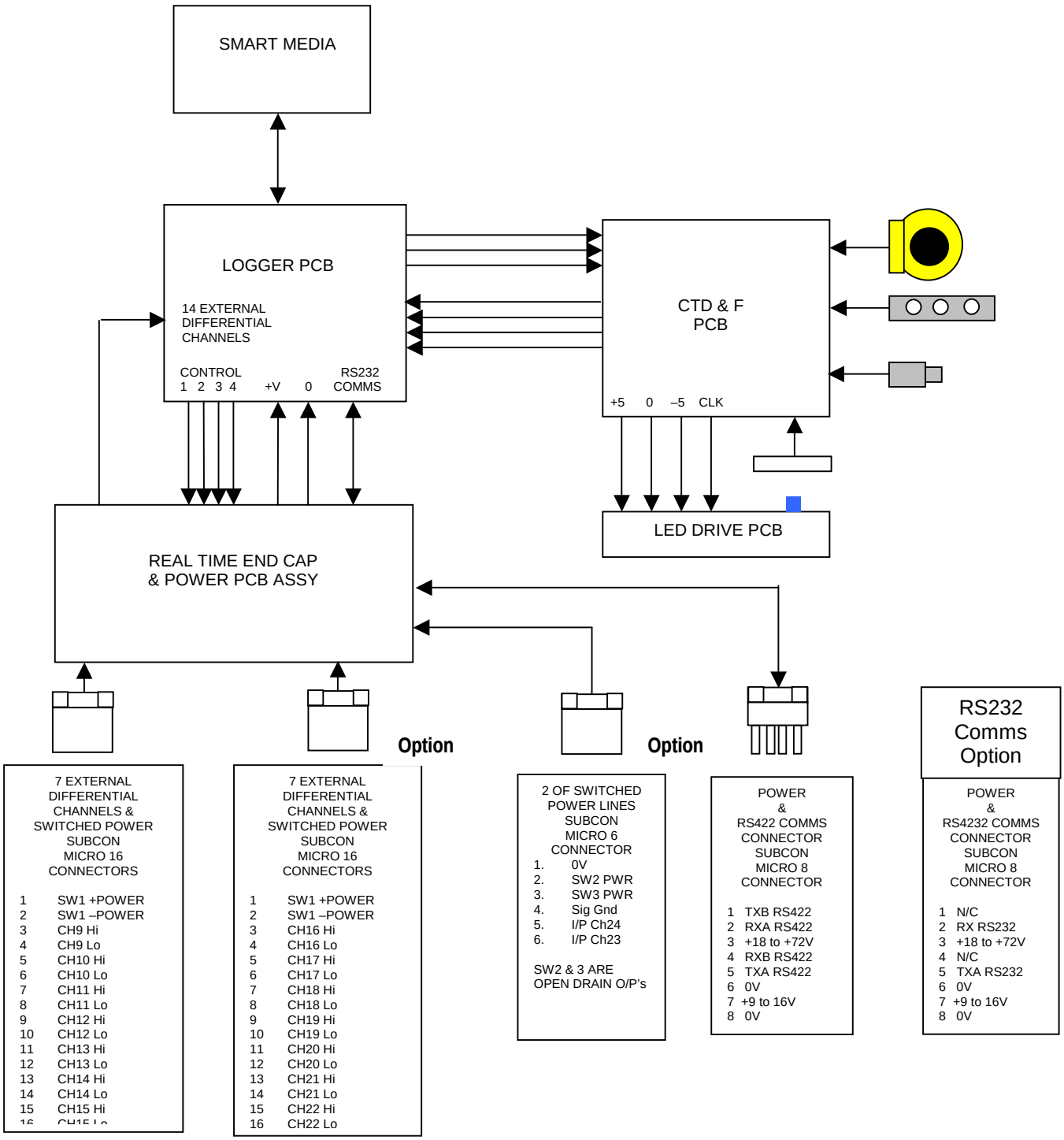
The End Cap Assembly for the Standalone configuration is configured to take the internal battery pack, comprised of two 3.6V Lithium 'D' cells. It has no external connectors. In Standalone mode the instrument is configured by a start-up file stored on the internal Smart Media Card.

This novel use of SmartMedia card technology enables the user to pre-programme the card, and extract data files directly with a PC. This gives 16Mbytes of easily removable onboard storage.

Stand-alone MINI*pack* Schematic



Real-Time MINI*pack* Schematic



Data Logger Board

The data logger is the centre of all of the intelligent units within the system. It controls the operation of the system sensors and communications with surface equipment.

CPU: Texas MSP430C337

Sea Water Switch

The sea water switch is a low power circuit, powered directly from the battery supply and takes the form of a missing pulse detector, whilst the pulses are present the battery supply is turned off to the main circuit. When MINI*pack* is immersed in water, a circuit is made between the sea water switch terminal and MINI*pack*'s case which is held at AC ground. The pulses are shunted to ground via this circuit and the missing pulse detector, detects there are no pulses and turns the battery supply on to the main circuitry.

COMMUNICATIONS AND DATA FORMATS

Real Time Mode Communications

In the Real Time mode of operation communication will be possible directly to the logger from a remote terminal. The logger communicates to the operator via a full-duplex asynchronous serial link conforming to the RS-422 standard. The link protocol parameters are:

Baud rate: 9600 baud, Parity: none, Data bits: 8, Stop bits: 1

The data logger is mounted on the electronics chassis housed inside the pressure housing. It can sample up to 24 analogue signals into an ADC with a digitising resolution of 16-bits. The raw conversions of the 24 channels are either logged for later retrieval or sent directly up the serial RS422 communications link

Data Formats

The instrument sensors are connected to the data logger's signal channels in the following order:

1	conductivity	2	temperature
3	pressure	4	fluorimeter signal
5	Battery Voltage	6	Battery Current
7	Reserved for internal use	8	Reserved for internal use
9	CH9	10	CH10
11	CH11	12	CH12
13	CH13	14	CH14
15	CH15	16	CH16
17	CH17	18	CH18
19	CH19	20	CH20
21	CH21	22	CH22
23	CH23	24	CH24

When operating in the Standalone mode the acquired data is stored in the memory card. At each scan the sensors are sampled through an ADC, the resulting 16-bit integer data is converted using the calibration values to provide accurate data representing the voltages, these are stored along with the timestamp and header block.

File Format

The stored data is held in a text file with a timestamp prepended to the data. The filename consists of the date & time when the logging started.

Each line of data has the following fixed format:

dd/mm/yyyy,hh:mm:ss,ch1,ch2,…..,ch24

where:	**dd/mm/yyyy**	**date**	
	hh:mm:ss	**time**	
	ch1	conductivity reading	±xx.xxx
	ch2	temperature reading	±xx.xxxx
	ch3	pressure reading	±xxx.xx
	ch4	fluorimeter reading	±xxx.xx
	ch5	battery voltage reading	±xx.xxxx
	ch6	battery current reading	±xx.xxxx
	ch7	TBD reading	±xx.xxxx
	ch8	TBD reading	±xx.xxxx
	ch9	channel 9 voltage reading	±xx.xxxx
	..	.....	
	ch24	channel 24 voltage reading	±xx.xxxx

POWER AND CONNECTORS

Input Power	Voltage
Power supply input (Standard Interface Unit)	18V – 72V
Power supply input (Portable Interface Unit)	9V – 16V
Battery supply input	9V – 16V
External Sensors (SW 1, 2 & 3)	12V @ 1A (Total)

External Connectors

Power & Communications Connector

Power & Comms	Connector MCBH8M	RS232 OPTION
Pin No	Designation	Designation
1	TXB RS422	N/C
2	RXA RS422	RX RS232
3	Power + (18V to 72V DC)	Power + (18V to 72V DC)
4	RXB RS422	N/C
5	TXA RS422	TX RS232
6	Power - (Common)	Power - (Common)
7	Battery Power + (9V to 16V DC)	Battery Power + (9V to 16V DC)
8	Power - (Common)	Power - (Common)

Switched Power Lines (Option)

Switched Power	Connector MCBH6F
Pin No	Designation
1	0V
2	SW2 PWR Open Drain O/P's
3	SW3 PWR Open Drain O/P's
4	Sig Gnd
5	Channel 24 Input
6	Channel 23 Input

Differential Channels & Power

Channels 9 to 15	**Connector MCBH16F**
Pin No	Designation
1	SW1 +Power
2	SW1 –Power
3	CH9 Hi
4	CH9 Lo
5	CH10 Hi
6	CH10 Lo
7	CH11 Hi
8	CH11 Lo
9	CH12 Hi
10	CH12 Lo
11	CH13 Hi
12	CH13 Lo
13	CH14 Hi
14	CH14 Lo
15	CH15 Hi
16	CH15 Lo

Channels 16 to 22 (Option)	**Connector MCBH16F**
Pin No	Designation
1	SW1+Power
2	SW1-Power
3	CH16 Hi
4	CH16 Lo
5	CH17 Hi
6	CH17 Lo
7	CH18Hi
8	CH18 Lo
9	CH19 Hi
10	CH19 Lo
11	CH20 Hi
12	CH20 Lo
13	CH21 Hi
14	CH21 Lo
15	CH22 Hi
16	CH22 Lo

GRAPHICAL USER INTERFACE (GUI)

The GUI referred to as the MINI*pack* Terminal Interface is a 32-bit Windows application used for both the real-time and standalone modes. The Standalone unit has a removable Smart Media card for the storage of the data wheras the real-time unit relies on transfer of data to the remote PC where the storage occurs. Error detection is used on all data transfers.

The GUI uses windows property sheets and contains the information as shown in the screens (as shown on the following pages) entered from the main menu (required for setting file names) and will be used to:

Setup:	Setup the instrument Date, Time, Address, Serial No., external switched power times and Acquisition times.
Switch Power:	Enter warmup time skip value for channels 2 & 3.
C, T, D &F:	Enter the Conductivity, Temperature, Depth and Fluorimeter sensor constants.
Calibration:	Enter the bits to voltage constants for all channels (Engineering function only)
Sensor Types:	Record the external sensor types and serial numbers.
Terminal Window:	Display the most recent readings in real-time and store with the header information in the PC or in Standalone mode read the memory card, convert to Engineering units and store in the PC.

Setup screen

The software starts with the Setup screen and attempts to read from the instrument the settings of Date, Time, Address, Serial No., Switched Power times and Acquisition times. The operator is required to enter valid settings and select the next TAB. The settings are sent to the instrument and if received correctly the C, T, D & F screen will appear.

C, T, D & F screen

The software attempts to read the x, x^2 and C constants for the internal sensors from the instrument and the operator is required to enter a password via a dialog box if he wants to EDIT any of these. From this screen if the Engineering password is entered the Calibration screen will appear, for entering of the bits to volts conversion. Selecting next TAB will send the new settings to the instrument and progress to the Sensor Types screen

Calibration screen (For external channels)

The calibration screen is an engineering function only, accessed by password from the C, T, D & F screen. Calibration numbers corresponding to 0.1V & 2.4V are entered for channel 5 to 24 channels. Selecting next TAB sends these calibration coefficient values to the instrument and if successful will return to the C, T, D & F screen.

Sensor Types screen

The Sensor types and corresponding serial numbers are read from the instrument and can be edited if required. Pressing **OK** sends the new settings to the instrument and progress to the Real-time screen.

MINI*pack* Terminal Interface Screen

In Real-Time mode the Terminal Interface screen displays the most recent readings from all the sensors. C, T, D & F are in Engineering units and the other sensors are voltage readings between 0 and +2.5Volts. As each reading is displayed it will be stored with the header information in a file in the PC.

In Standalone mode the Terminal Interface screen displays the data from the memory card after the conversion to Engineering units, the converted data is stored to a PC file.

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