



ESA Messtechnik GmbH

Schlossstr. 119 - D-82140 Olching / München
Telefon: +49 (0)8142 444 130 - Fax: +49 (0)8142 444 131
Internet: www.esa-messtechnik.de
E-Mail: info@esa-messtechnik.de

Signal Conditioner Amplifier and Data Acquisition System *Traveller CFM*



Traveller CFM (ET1CFM) is a very compact, high performance data acquisition and analog signal conditioning system.

The Traveller CFM system can be used for static and dynamic applications in experimental stress analysis, e.g. to measure analog signals from strain gauges in all common bridge configurations, strain gauge based transducers, potentiometers and general voltage sources, and also to measure asynchronous digital signals up to 4 bits from any type of sensors with digital output. The system uses one connector for each analog channel to simplify the wiring, thus reducing wiring errors and potential damage.

The Traveller CFM with its possibility of wireless data transfer is an excellent choice for mobile applications on board of any kind of vehicles, aircrafts and sea-going crafts, moving machinery, and the like.



Remote Control UNIT (RCU)



Size comparison between *Traveller CF* and *Traveller CFM*

Using a special "ESAM" software, the ET1CFM system allows for configuration and control of all parameters of each individual conditioning channel, A/D converting mode, trigger mode, sampling frequency and data transfer from the host computer via USB communication interface, thus reducing the time and risk of faulty configurations and connections. This software works flawlessly under Windows®2000 and Windows®XP.

ET1CFM was designed for excellent shock and vibration resistance consistent with EMI and RFI.

FEATURES

- Measurement of signals with frequency band up to 5000 Hz (in SGA1D module only).
- Software selectable sampling frequency rate from the range 0.007 to 100000 samples/sec for each analog channel.
- Simultaneous Sample & Hold circuit with all analog channels.
- High precision, high speed and low noise 16-bits A/D converter with each analog channel.
- Up to 32 inputs of conditioned analog channels in one single housing cabinet.
- Possibility to synchronize up to 10 system boxes in LOCAL mode (special connection cable on demand).
- Software programmable digital averaging filters (linear phase) for noise reduction, separate for each analog channel.
- High speed, high performance USB 2.0 type interfaces to transfer data or commands to or from ET1CFM.
- Internal high performance, high speed micro controller circuit, with high capacity FLASH and EEPROM memories to store all settings and parameters of the system in non-volatile memory.
- Built-in special interface for external Remote Control Unit (RCU) to work in LOCAL mode, without the computer connected to USB port of the system.
- Built-in Real Time Clock circuit (RTC, minimum battery life time 10 years), easy to up-grade from PC computer system clock.
- High speed Compact Flash (CF) card interface to store system configurations and converted data stream in Windows® compatible file format (total capacity up to 2 GB).
- Built-in CF card reader allowing the user to read any type of CF cards, and copy CF card files to PC hard disk.
- Built in PCM system ENCODER allows for data transfer over long distances using cables or telemetry transmitters (optional).
- Possibility to store an entire system configuration on special CF card file and restore it at any time.
- Possibility to upgrade the firmware of all internal micro controllers (inside the system) via USB interfaces.
- 64 combinations of 8 different modes of START / STOP internal trigger circuit allow for automatic registration of data stream without user interference.
- USB port to program/control the system from PC.
- 4 lines of buffered asynchronous digital input and output port.
- Settings and parameters of an entire system fully software controlled.
- Super low power technology and internal isolated 12 to 32 VDC single power supply module.
- Low Voltage Monitor circuit (option) to prevent loss of measuring data (during CF card write) during power supply failure.
- Optional Remote Control Unit (RCU), including keyboard and 2 x 20 characters low power LCD display, with possibility of software selectable two different highlighting methods of LCD background.
- System drivers for Windows®2000 or Windows®XP (preferred) operating systems.
- Integrated user-friendly high level software "ESAM".

Technical Specifications (Basic Unit):

Analog / Digital Input Boards	
Types:	The measurement system ET1CFM provides acquisition and digitization of up to 32 channels of various analog/digital inputs.
Currently available types of I/O boards:	Examples: SGA1D – Analog Conditioner/Amplifier Board (basic type), CNT0D – Digital Counters Board.
Configuration:	Up to 8 analog/digital conditioners per board, and up to 4 boards per single system box.
A/D Converter Subsystem	
A/D converter type:	16-bit successive approximation with integrated simultaneous sample and hold circuit for each analog channel.
Sampling Rate:	Max. 100000 samples/second per analog/digital channel (software programmable).
Asynchronous Digital I/O port	
Input Type:	HCT standard (asynchronous lines).
No. of Lines:	4.
Output Type:	HCT standard (asynchronous lines).
No. of Lines:	4.
Keyboard and LCD Display in optional RCU unit	
Display Type:	LCD, 2 x 20 characters with integrated LCD controller.
Keyboard:	6 asynchronously serviced soft touch keys.
Power Supply	
Supply Voltage:	12 to 32 VDC, external high performance, stabilized power source (CE consistent). <i>Note:</i> A supply voltage of min. 24VDC is strongly recommended.
Power Consumption:	For four SGA1D type modules installed in a 32-channels system: 28 W max.
Fuse:	2,5A slow fuse.
Low Voltage Monitor (option):	Threshold voltage level is about 11 VDC as default setting. Below this level the system will indicate bad power supply conditions by blinking of LVM green LED on the front panel or LCD display and by a BEEP sound if RCU circuit is connected.
System Setup Time:	Max. 5 seconds.
System Box	
Size and Weight:	101 mm x 214 mm x 84 mm; 2 kg - for 32-channels system housing
Cabinet Protection Code:	IP 50 (EN 60529, IEC 60529:2001).
Environmental	
Operating Temperature Range:	0 ° to +50 °C.
Storage Temperature Range:	-20 ° to +70 °C.
Humidity:	Up to 95% R.H. without condensation.
Sampling Clock Generator	
Type:	Internal, software controlled pacer clock generator.
Basic Frequency:	30 MHz, ±0.01 % with 50 ppm stability.
Usable Frequency Range:	0.007Hz to 100000Hz (fully software programmable).
PCM Encoder Module (Option)	
PCM Format:	IRIG 106 Telemetry Standard complaisant sub-format
Bit Rate:	4.0 Kbits/sec to 10.0 Mbits/sec
PCM Code:	Bi-phase code BI-L (Manchester code).
Data Word Length:	16 Bits.
Synchronization Pattern:	Two synchronization words.
PCM Frame Length:	9 to 136 PCM words.
Header of PCM Frame:	8 organisation and information words.
Data Area of PCM Frame:	1 to 128 data words.

Data Output:	LVTTTL compatible standard (50 Ω cable also accepted).
Output Connector:	SMA type.
Flash Memory Card	
Type:	Compact Flash Memory Card (CF or CF+ card types accepted).
Accepted Format:	FAT16, Windows [®] compatible format.
Maximum Capacity:	Currently up to 2 GB.
Storage Rate:	Typically 600 KSamples/second (depends on CF card type).
Main Communication Interface	
System Programming:	Universal Serial Bus, Revision 2.0 (USB 1.1 compatible).
Data Transfer:	Universal Serial Bus, Revision 2.0 (USB 1.1 compatible).
Transfer Throughput Rate:	Continuous transfer up to 8 Mbytes/second (USB2.0). Continuous transfer up to 1 Mbytes/second (USB1.1).
Software & Drivers	
Software:	Accessible only by full user-friendly measurement system "ESAM".

Conditioner/Amplifier SGA-1D Module

Description

The SGA-1D module is a high precision, programmable Strain Gauge Input Board for strain gauges, strain gauge based transducers, potentiometers, and other voltage sources with input characteristics compatible with the Conditioner/Amplifier channel.

FEATURES

- 8 analog channels per single PC-board.
- Programmable constant-voltage bridge excitation, individually software selectable for each analog board.
- Programmable gain, individually adjustable for each channel.
- Bridge completion resistors for half- and quarter bridges (350/120 Ω , option-1000 Ω) strain gauge and transducer circuits.
- Built in shunt calibration circuit, using low impedance internal switches, allows for software selection of adequate configurations of calibration circuits.
- Built-in 4-pole 5000Hz (-3dB) fixed Butterworth low-pass filter.
- Digital averaging filter, up to 8 samples used for the averaging procedure of one single measurement for each channel on the board.
- Software programmable electronic bridge-balance circuit with possibility of synchronous automatic balance of all analog channels on the board.
- Fully programmable features: bridge excitation, gain, calibration, averaging filter, bridge balance and channels activity.
- Individual high speed 16-bits A/D converters (100.000 samples/sec) for each analog channel.
- Simultaneous Sample and Hold of all analog channels.
- All functions and settings of analog channels inside the board are controlled and serviced by a high speed, low power CMOS micro controller (no external jumpers, potentiometers, switches etc.).

Technical Specifications Strain Gauge Input Board Mod. SGA-1D:

Number of Channels:	8 complete signal conditioner amplifier channels per board
Input of single Analog Channel	
Configuration:	Two up to four wires and guard shield to accept quarter, half, or full bridge strain gauge circuits, transducer or voltage sources. Internal half bridge, 350 Ω and 120 Ω (1000 Ω -option) dummy resistors, internal shunt calibration circuits.
Common Mode Voltage:	± 2.5 V
Input Range:	$\pm 2,5$ V

Input Protection Voltage:	± 30 V
Input Impedance:	20MΩ at 1500pF
Measurement Ranges	
Gain = 1, 2, 4, 8:	Input Voltage Range: ±2.500 V, ±1.250 V, ±0.625 V, ±0,3125 V.
Gain = 50:	±20000 µm/m for bridge excitation 5.000 V and gauge factor K=2, Input Voltage Range: ±50 mV.
Gain = 100:	±10000 µm/m for bridge excitation 5.000 V and gauge factor K=2, Input Voltage Range: ±25 mV.
Gain = 200:	±5000 µm/m for bridge excitation 5.000 V and gauge factor K=2, Input Voltage Range: ±12.5 mV.
Gain = 400:	±2500 µm/m for bridge excitation 5.000 V and gauge factor K=2, Input Voltage Range: ±6.25 mV.
Constant Voltage Bridge Excitation	
Range:	0 to 7 VDC – software-programmable, increments of 2.5 mV, excitation voltage common to all channels on the board.
Current Efficiency:	40 mA per analog channel, with over current protection circuit fixed to 320 mA for all channels on the board (8 x 40mA).
Voltage Accuracy:	0.1 %
Temperature Stability:	0.01 %/K.
Bridge Balance Circuitry	
Type:	Internal microprocessor-controlled electronic balance circuitry.
Range:	±100 % of measurement range, resolution 16-Bits.
Calibration	
Calibration:	The SGA-1D Strain Gauge Amplifier contains three internal shunt calibration resistors: RC1 = 174.65k 0.1 %, 1000 µm/m (0.50mV/V) for 350 Ω and gauge factor K=2.00, RC2 = 59.88k 0.1 %, 1000 µm/m (0.50mV/V) for 120 Ω and gauge factor K=2.00, RC3 = 499k 0.1 %, 1000 µm/m (0.50mV/V) for 1000 Ω and gauge factor K=2.00. Software controlled electronic switches allow for various configurations of calibration circuits.
Amplifier	
Noise:	(with 350 Ω source impedance), Referred to Input (RTI): <2µV RMS at 0.1 Hz to 10 kHz.
Accuracy:	±0.2 %
Nonlinearity:	0.005 % of Full Scale Range.
Slew Rate:	≥0.3V / µsec
Temperature Co. of Zero:	± 0.5 µV/K for Gains 100 and 1000
Common Mode Rejection:	G=1 80 dB, G=10 90 dB, G=100 100 dB, G=1000 110 dB
Filter:	4-pole Butterworth low-pass filter for each channel; cutoff frequency: 5kHz (-3 ±1dB)
A/D Conversion	
A/D Converter Type:	16-bit successive approximation with integrated sample and hold circuit. Individual A/D-converter on each channel and simultaneous sampling for all channels
Output Data Code:	Binary Two's Complement.
Output Code Decimal Range:	-32768 to +32767.
Integral Linearity Error:	± 0,006 % of FSR.
Signal-to-(Noise + Distortion):	84dB.
Analog Sampling Rate:	100 000 simultaneous samples per second for each channel.

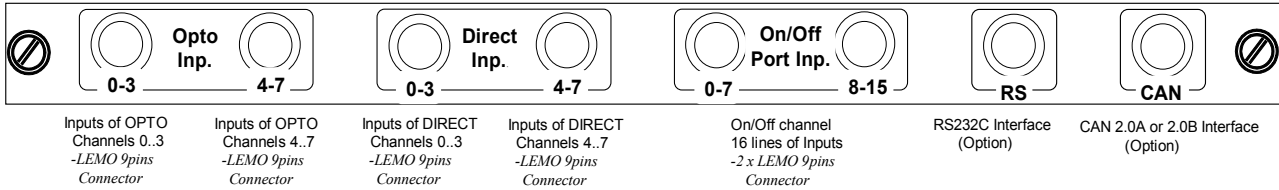
Digital Counters Board CNT-0D Module

Description

CNT-0D Digital Counters Board is a newly designed member of ET1CFM system board's family. In general, the CNT-0D module holds up to 8 simultaneously sampled inputs of digital channels.

Data from each digital channel of CNT0D are transferred as single 16-bits words of the ET1CFM data frame. The channel data supplied from a particular digital channel can be the physical input from any one of the following modules:

- COUNTER module - this module can be programmed to work in various modes
- On/Off channels module.
- RS - not implemented at the moment.
- CAN - not implemented at the moment.



Description of connectors:

1. LEMO type **EGG.0B.309.CLL** : OPTO INPUTS (two 9 pins connectors). Optically isolated inputs of 8 digital 16-bits counters implemented on the CNT0D board. These inputs have a high input impedance and are also compatible with TTL and LVTTTL standard logics. Optically isolated inputs directly drive the counter modules (for counters details see description below).
2. LEMO type **EGG.0B.309.CLL** : DIRECT INPUTS (two 9 pins connectors). Direct inputs (not optically isolated) of 8 digital 16-bits counters implemented on the CNT0D board. These inputs have high input impedance and are compatible with TTL and LVTTTL standards logic. Direct inputs directly drive counter modules (for counters details see description below).
3. LEMO type **EGG.0B.309.CLL** : ON/OFF port inputs. These inputs (not optically isolated) of 16 lines of digital On/Off channels are compatible with TTL standard. The signal lines form 16-bits words are transferred as single data words of the ET1CFM data frame. The data words replace particular the data from any digital channel in CNT0D data stream (if the input channel is enabled).

Technical Specifications Digital Counters Board CNT-0D:

General	
Configuration:	Up to 8 digital channels
Resolution:	16-bits, binary coded.
Power Consumption:	Maximum 1 W.
Clock Generator:	0.72 Hz to 6 MHz, freely software programmable, individually for each digital counter.
Clock Stability:	30 ppm.
Counter Accuracy:	0.003 % ±1 digit.
Counter Accuracy:	Min. 500nsec high pulse
Input Impedance:	≥ 400kΩ at 50pF
Logic High Level:	≥ 1 V (TTL & LVTTTL input logic also accepted).
Logic Low Level:	≤ 0.2 V (TTL & LVTTTL input logic also accepted).
Input Protection:	Continuously up to ±30 V _{p-p} .
Direct Inputs	
Max. Input Frequency:	1 MHz for input signals with amplitudes up to 2V or 1.5 MHz for input signals with amplitudes >2V.
Optically Isolated Inputs	
Max. Input Frequency:	0.5 MHz for input signals with amplitude up to 2V or 1 MHz for input signals with amplitude >2V.
ON/OFF Inputs	
Input Logic Type:	Standard TTL, but HCTTL or LVTTTL signals are also accepted.

Modifications based on advanced technical developments possible!