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**1 FE-MM16 System**

**1.1 General Description**

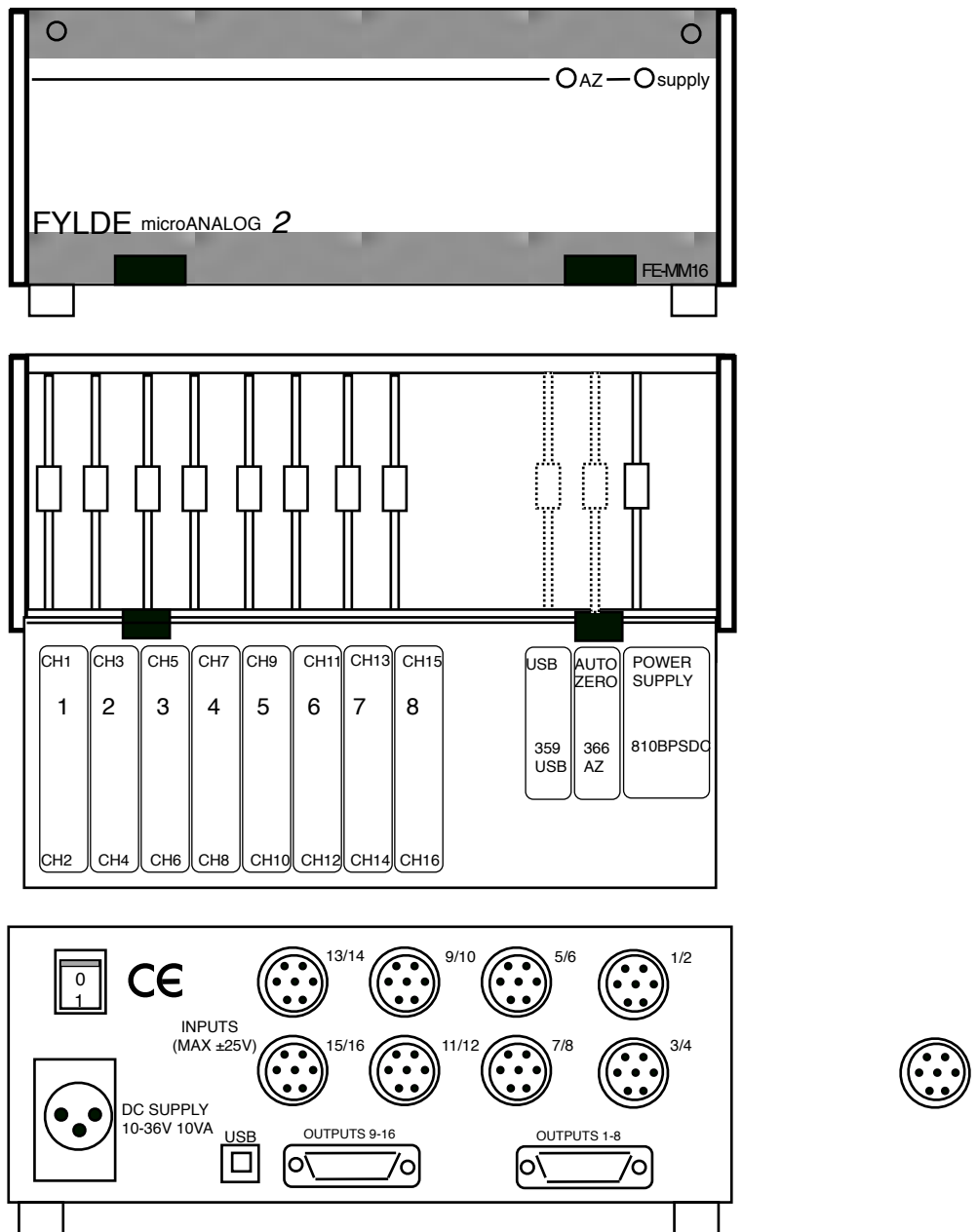
The MM16 is a nominally 16 channel system able to accept up to 8 Micro-Analog dual channel signal conditioning modules. The system is D.C. powered at any voltage between 10 and 36 V.

Before using the system for the first time it is necessary to follow the information provided in this manual regarding configuration and operation of the signal conditioning modules and the connection of transducers or other signal sources to the input connectors.

For access to the modules, the front panel is released by unscrewing the two knurled fastenings.

Be sure to isolate the system from the power source before removing or replacing any module. Modules are withdrawn from the racking by means of the centre mounted handles. The signal conditioning modules may be interchanged in any of the left hand 8 card positions.

The power supply module always occupies the right hand slot.



Inside the front panel is an ident guide. This surface may be labelled as required by the user with notes of individual channel information such as gain setting etc.

## 1.2 Power Supply FE-810-BPSDC

The FE-810-BPSDC power supply is fitted in “DC Micro-analogue 2” systems to energise a number of transducers from a stable low noise source, and to provide stable power to the amplifier modules.

The FE-810-BPSA has two transducer supply outputs, one being the +5.00 V/+2.50 V capable of up to 800 mA, and the other a +10.00 V supply capable of up to 600 mA.

Note that although the supply is designated +5 V/+2.5 V , 0 V and -5 V on the backplane, this is intended to show that the +10.00 V supply is balanced rather than to imply that an independent -5 V transducer supply is available. Using the -5 V supply independently of the +5 V supply is not recommended.

The selection of +5 V or +2.5 V is by use of a jumper (J2) which is situated at the rear of the power supply module. The jumper in its upper position selects +5 V, and in its lower position selects +2.5 V. (See user drawing appended to this section of the handbook).

A feature of this module is its overload protection. When the power supply module’s DC/DC converter detects that the current being drawn exceeds the specified maximum, the output power is switched off. The module continuously attempts to restart the output, but it will only restart if the current drawn is not excessive. When the output current is within specification the green indicator is illuminated continuously, and while the overload is present the indicator flashes. The module operates in this way with the jumpers in the factory set position.

In general the overload protection is useful, since most faults will be indicated and can be traced without difficulty. For example, a short circuit can easily be traced by withdrawing modules one at a time (with the power off of course), and then switching on to see if the fault persists.

It should be recognised that the overload protection will remove the power from every transducer in the event of an overload anywhere in the transducer amplifier system. This should be borne in mind if vital measurements in a multi-channel system are jeopardised by a single wiring failure.

To solve this potential problem modules have positions for fuses which can be fitted to allow uninterrupted operation in the presence of individual channel faults. (Standard modules have links in these positions; fuses are an option.)

Fine controls are provided to adjust the output voltages. This facility may be utilised to allow for volt drops which can occur in long input cables. Note that the power supply will have been set to exactly 5 V, 2.5 V and 10 V at the factory and in practice the user may wish to leave these controls undisturbed.

## 1.3 USB Interface FE-359-USB

The FE-MM16 Micro Analog 2 case may be fitted with a USB data acquisition module (FE-359-USB). When fitted the FE-MM16 USB connector is available for connection to a computer. There are no user settings on the USB module and the installation and operating instructions are provided on a memory stick or CD.

The specification of the USB interface is provided in the appendix to this manual.

## 1.4 Output Connections

The output connections are via a pair of 15 way 'D' sockets identical to those used on the 8 channel system FE-MM8.

FYLDE offer a BNC expander box to fit these connectors (Type FE-MAC-8C) - two of these will be needed to allow all outputs to be connected via BNC connectors. Additionally, each FE-MAC-8C carries a 9 way "D" connector for Digital control lines Calibration and Auto Zero (see Note 1).

Connectors may also be obtained to suit various data acquisition systems - please contact the factory for advice.

### Connector OUTPUT 1.

Pin Number	Function	Detail
1	Output 1	A nominally $\pm 10$ V output from channel 'a' of card one
2	Output 2	A nominally $\pm 10$ V output from channel 'b' of card one
3	Output 3	A nominally $\pm 10$ V output from channel 'a' of card two
4	Output 4	A nominally $\pm 10$ V output from channel 'b' of card two
5	Output 5	A nominally $\pm 10$ V output from channel 'a' of card three
6	Output 6	A nominally $\pm 10$ V output from channel 'b' of card three
7	Output 7	A nominally $\pm 10$ V output from channel 'a' of card four
8	Output 8	A nominally $\pm 10$ V output from channel 'b' of card four
9	Digital Output 0	Push Pull (+5V) output from USB (see note 1)
10	Digital Output 1	Push Pull (+5V) output from USB (see note 1)
11	Analog common	All output voltages are relative to the common on this pin
12	Digital Input 0	TTL (+5V) digital input. (see note 2)
13	Digital Input 1	TTL (+5V) digital input. (see note 2)
14	Digital Input 2	TTL (+5V) digital input. (see note 2)
15	Digital common	Digital I/O levels are relative to the common on this pin.

### Connector OUTPUT 2.

Pin Number	Function	Detail
1	Output 9	A nominally $\pm 10$ V output from channel 'a' of card five
2	Output 10	A nominally $\pm 10$ V output from channel 'b' of card five
3	Output 11	A nominally $\pm 10$ V output from channel 'a' of card six
4	Output 12	A nominally $\pm 10$ V output from channel 'b' of card six
5	Output 13	A nominally $\pm 10$ V output from channel 'a' of card seven
6	Output 14	A nominally $\pm 10$ V output from channel 'b' of card seven
7	Output 15	A nominally $\pm 10$ V output from channel 'a' of card eight
8	Output 16	A nominally $\pm 10$ V output from channel 'b' of card eight
9	Digital Output 2	Push Pull (+5V) output from USB (see note 1)
10	+12V	+12V relative to pin 11.
11	Analog common	All output voltages are relative to the common on this pin
12	Digital Input 3	TTL (+5V) digital input. (see note 2)
13	Digital Output 2	Push Pull (+5V) output from USB (see note 1)
14	Digital common	Digital I/O levels are relative to the common on this pin.
15	Not Connected	Not connected.

**Note 1:** Note that digital output 2 is internally connected to the shunt calibration control of any FE-366-TA modules fitted and digital output 3 is internally connected to the Auto Zero control of the FE-366-AZ module (if fitted.)

**Note 2:** Digital input 3 is internally connected to the AZ in progress control of the FE-366-AZ module (if fitted).

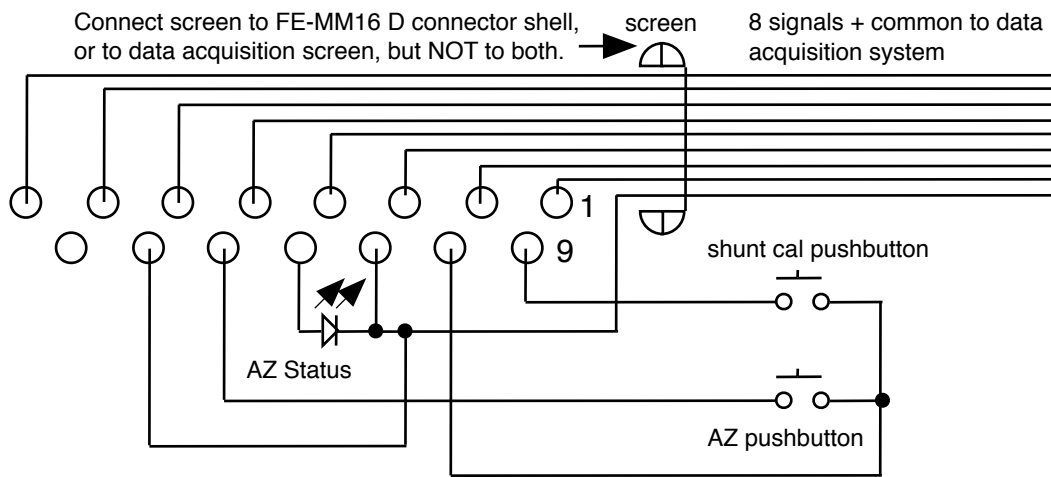
**1.4.1 Connections with FE-359-USB fitted.**

When the FE-357-USB interface is fitted, there are four digital outputs and four digital inputs available on the two connectors OUTPUT 1 and OUTPUT 2. If any FE-366-TA modules are fitted, Digital Output 2 must be used only to control the shunt calibration function. If the FE-366-AZ module is fitted, Digital Output 3 and Digital Input 3 must be used only to control the Auto Zero function.

If any slot for a signal conditioning module is empty, the corresponding pair of signals on the 15 way connector can be used as an analogue voltage input. Each input used in this way has a  $\pm 10V$  range relative to pin 11 (analogue 0V).

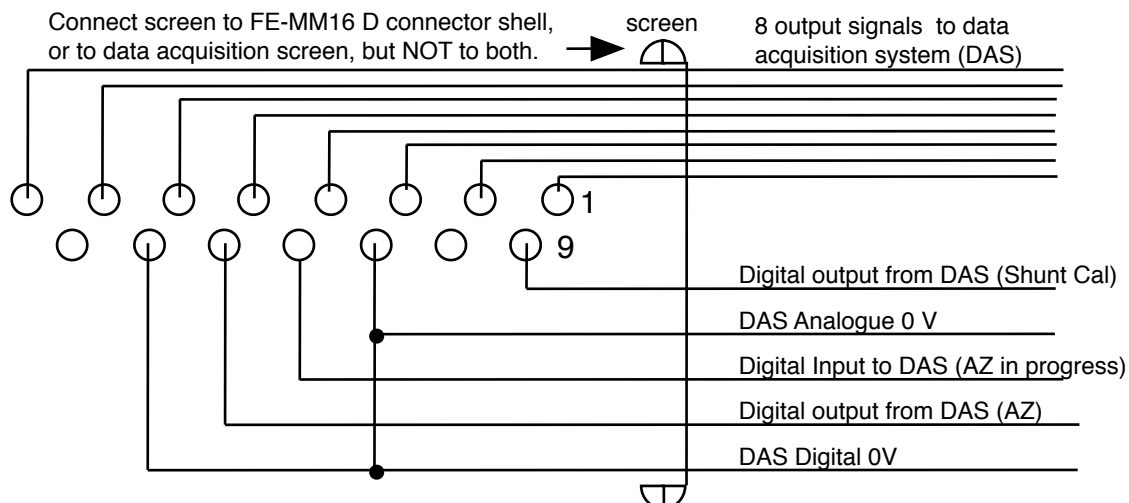
**1.4.2 Connections without FE-359-USB fitted.**

When no FE-359-USB interface is fitted, the Auto Zero and Shunt Calibration functions may be controlled by external pushbuttons connected to OUTPUT 2 as shown below.



Note that a Light Emitting Diode (LED) may be directly connected across pins 11 and 12 to indicate AZ status.

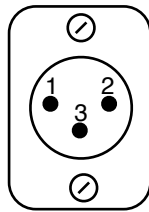
Alternatively when no FE-357-USB interface is fitted, the Auto Zero and Shunt Calibration functions may be controlled by the I/O of a data acquisition system (DAS) connected to OUTPUT 2 as shown below.



Note 1. The link between Digital 0 V and Analogue 0 V is necessary only if the signal AZ in progress is to be used.

## 1.5 Power Connections

The Power input connector is a 3 pin XCON plug with latching mechanism.



- 1. +V
- 2. 0V
- 3. N.C.

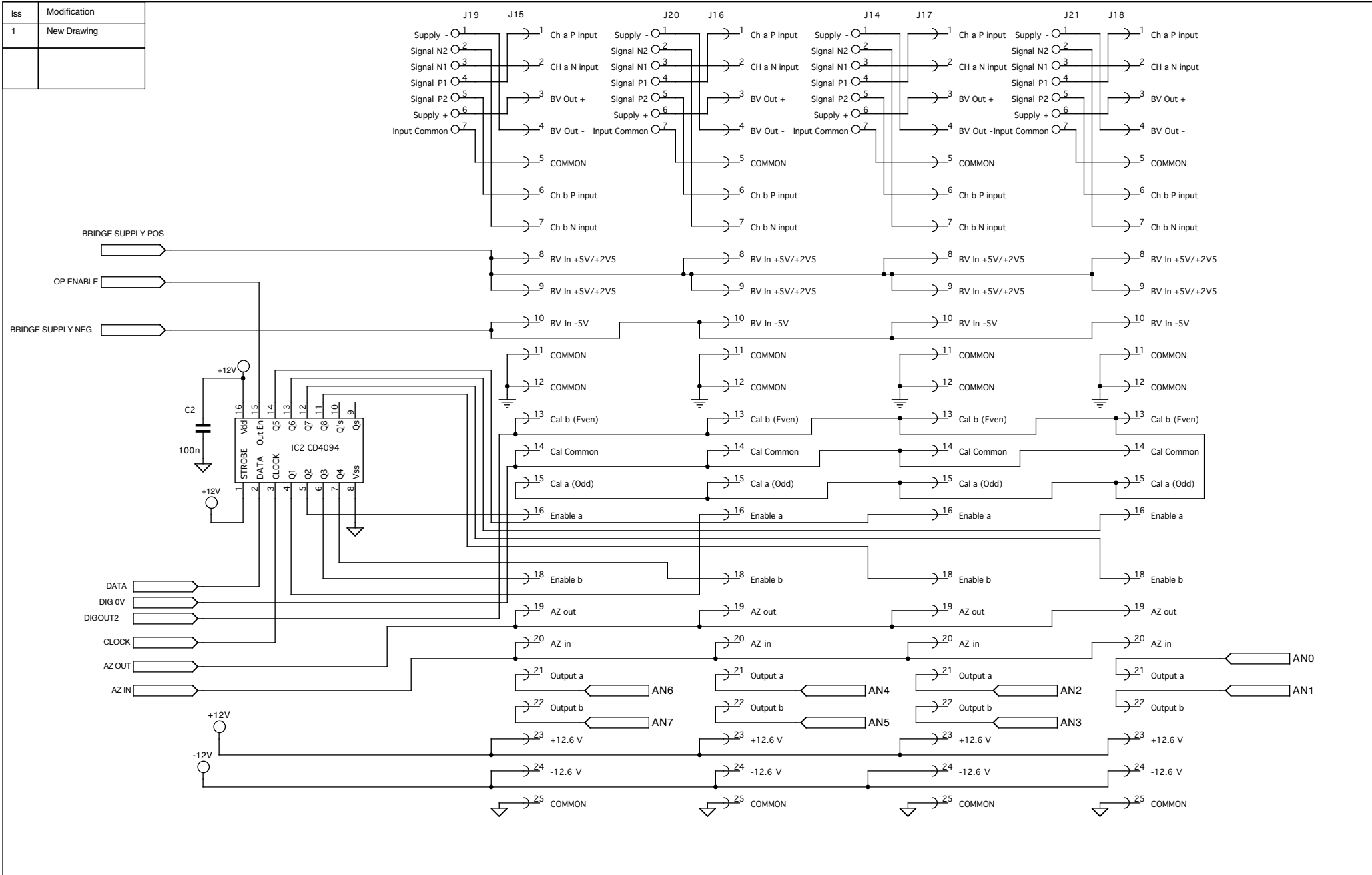
Pin 3 is reserved and should not be used.

Power requirement is 10V to 36V DC at 10VA typ.

A wide range low noise mains adaptor is available as an optional extra.

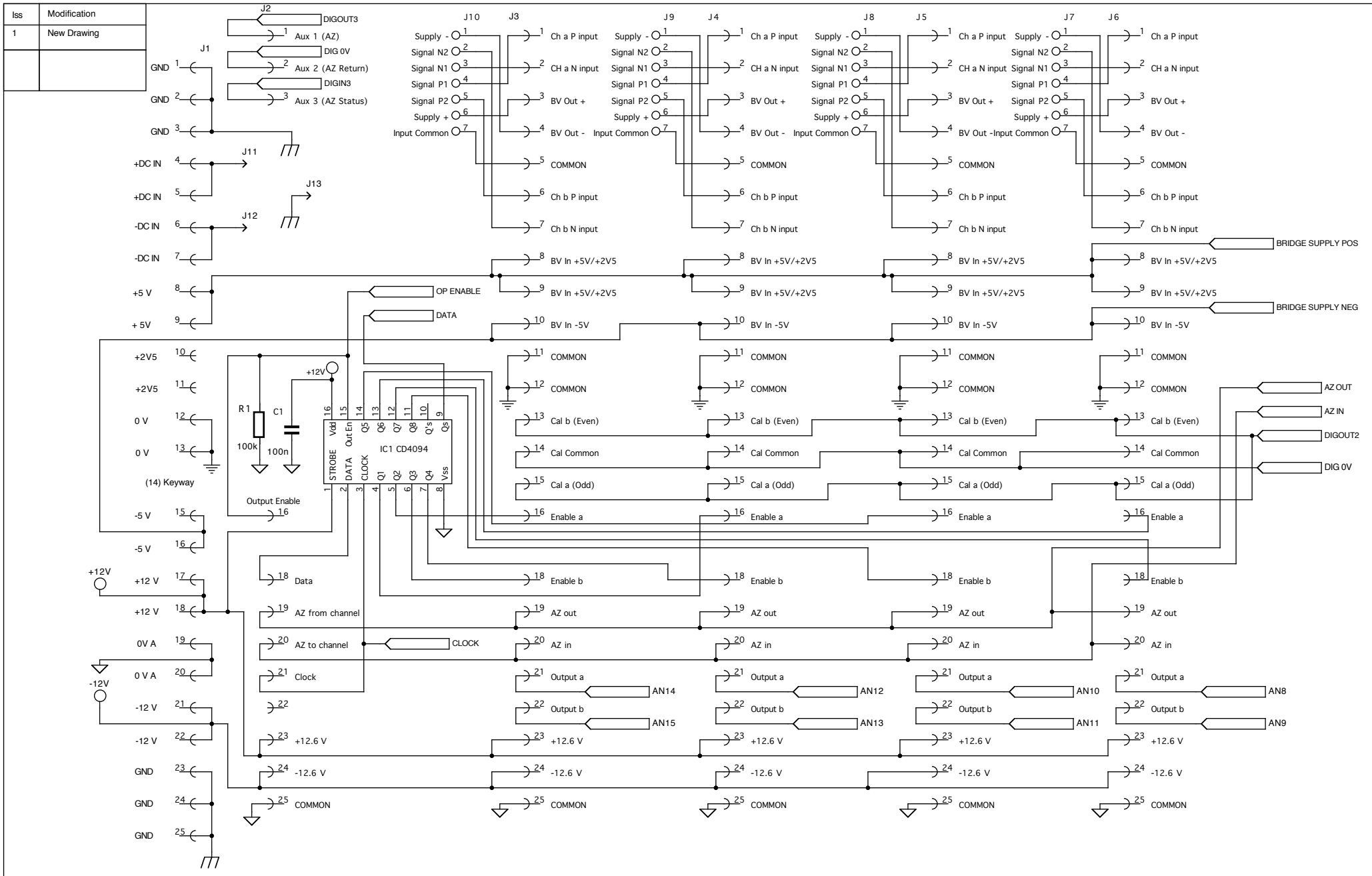
**Appendix**

Iss	Modification
1	New Drawing



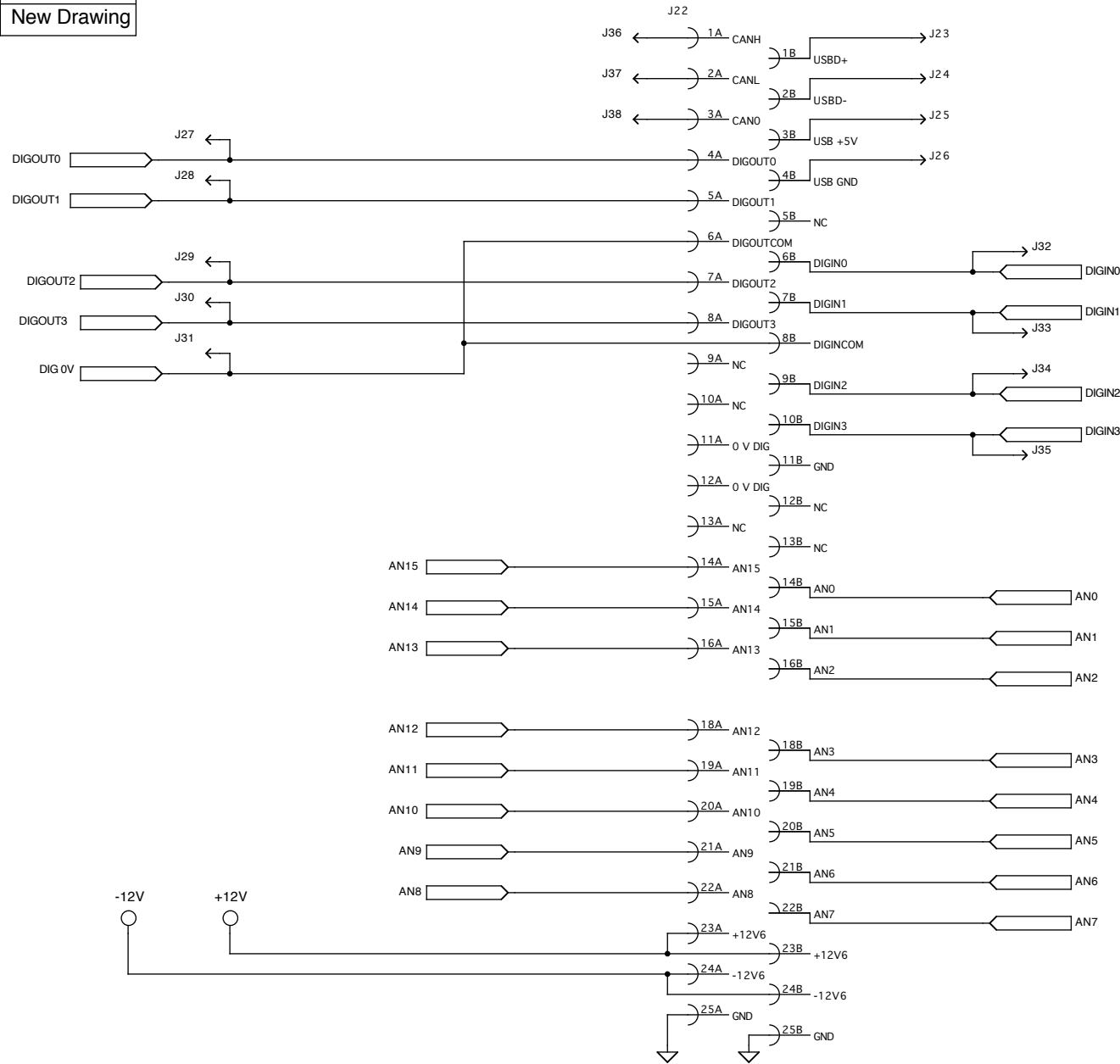
FE-MM16 Backplane Chs 1 to 8	Ref	Dwg No. 1363C	Issue 1	Date 26/7/04	Checked
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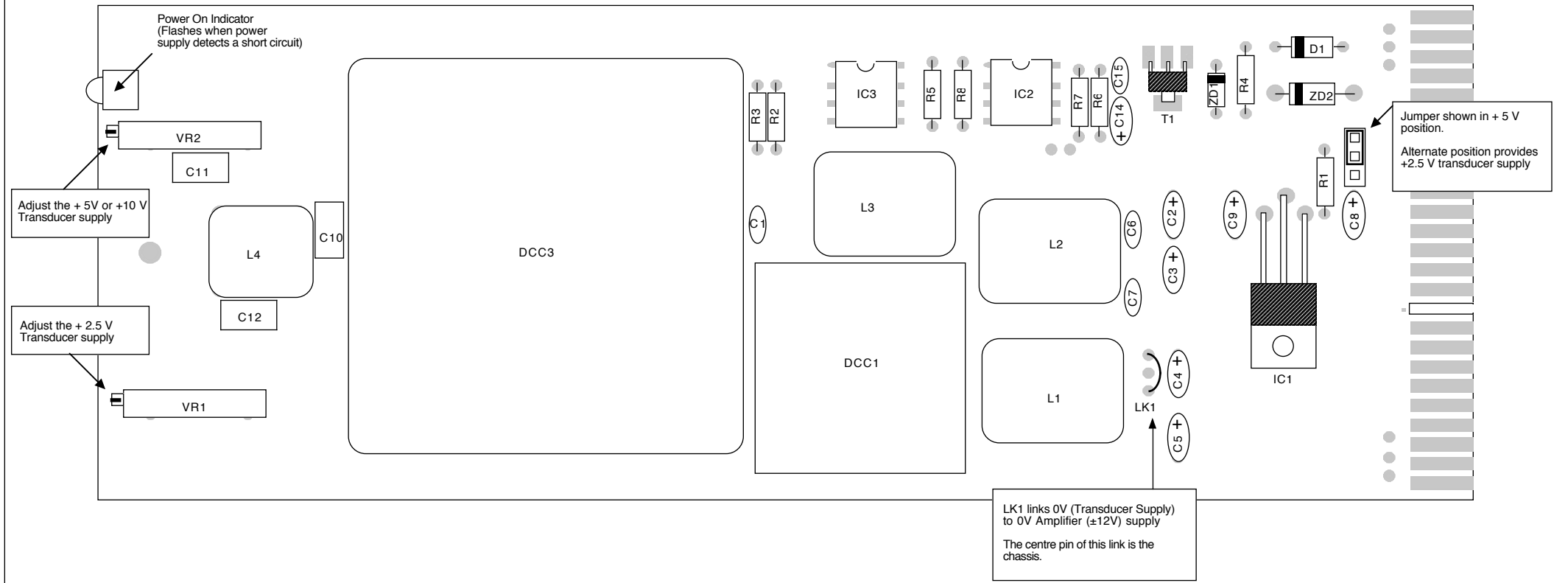
FE-MM16 USB Backplane Chs 9 to 16 , AZ+PSU	Ref	Dwg No. 1364C	Issue 1	Date 26/7/04	Checked
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Iss	Modification
1	New Drawing



FE-MM16 USB Backplane , USB Edge Connector	Ref	Dwg No. 1365C	Issue 1	Date 26/7/04	Checked
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Iss	Modification
1	New Drawing (10/7/00)
2	See NCR 776 (20/1/10)



FE-810-BPSDC $\mu$ A2 DC PSU	Ref	Drg No. 898PC	Issue 2	Date 20/1/10	Checked
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**Introduction**

A Micro Analog 2 system comprises a chassis, a backplane and a set of printed circuit card modules (PCBs) which plug into the backplane through the front opening in the chassis. The rear panel carries all system connectors (power, input, output, USB.)

More details of the Micro Analog 2 system can be found on the Fylde web site <http://www.fylde.com>.

This FE-359-USB module provides 16 analogue input channels together with USB data acquisition for the FE-MM16 system.

**USB Interface Module : Specification**

Analog Inputs	Quantity Operating Range	16 signals from eight dual channel transducer interface modules. ±10.24 V relative to Analog 0 V. Note that these inputs signals remain available as system analog outputs on the 15 way D connectors at the rear of the FE-MM16. When a slot is not fitted with signal conditioning modules, ±10V signals may be acquired directly from the 15 way D connector.
Digital Outputs	Quantity Level	4 signals. +5 V push pull
Digital Inputs	Quantity Level	4 signals. On > 3.3 V, Off < 0.7 V
A to D Conversion	Resolution Range Sampling Rate Offset Noise Crosstalk Absolute Gain Error	16 bits ±10 V Maximum 16 x 25 000 samples per second. or 8 channels at 50 000 samples per second. < ±5 mV < 2 mV pk-pk -95 dB at 50 kS/s with 5k Hz sine wave input < 0.1%
Environment	Temp. Range	-40°C to +85°C operating. System startup to be at -15 °C or above. The module is conformally coated to avoid condensation effects.
Electrical	Power dissipation	0.75 W
Standards	USB	Universal Serial Bus Specification Revision 1.1
	EMC	The complete system complies with the requirements of the EMC directive 89/336/EEC ; the applicable standard is EN 61326.
	Safety	The completed system complies with the protective requirements of Low Voltage Directive 73/23/EEC and Amending Directive 93/68/EEC ; the applicable harmonised standard is EN 61010-1 (Industrial Equipment).

**USB Interface Module : General Description.**

An FPGA controls two 16 bit 8 channel ADCs which are continuously sampled at 50 kS/s on each channel. Data is buffered in a 4 Mbit (512k x 8) static RAM. On demand from the host the buffered data is USB block transferred using a FTDI 2232D FIFO device.

A second channel of the FTDI 2232D device is configured as a high speed (920 000 baud) USART. An ARM Cortex M4 processor acquires digital I/O data. A 1 kHz synchronisation signal from the FPGA causes all samples to be sent via the USART to the FTDI 2232D which block transfers the data to the USB host.

**Host Device Driver Software.**

The FTDI 2232D device driver is available for download from the FTDI website.

**Data Acquisition Package Support.**

A DLL interface is the API (Application Program Interface) The header file FE359USBLIB.c provides full details on how to use this DLL.

LabView programs are provided to demonstrate the DLL functions.