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USERS GUIDE

for the

EXP-RES
SIGNAL CONDITIONING
MULTIPLEXER
MODULE

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WARRANTY

All products manufactured by MetraByte are warranted against defective materials and workmanship for a period of One Year from the date of delivery to the original purchaser. Any product found to be defective within the warranty period will, at the option of MetraByte, be repaired or replaced. This warranty does not apply to products which have been damaged by improper use.

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!! WARNING !!

MetraByte Corporation assumes no liability for damages consequent to the use of this product. **This product is not designed with components of a level of reliability suitable for use in life support of other extremely critical systems.**

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EXP-RES TABLE OF CONTENTS

1.0 INTRODUCTION

EXP-RES 8-Channel Signal Conditioning Multiplexer

The EXP-RES is an 8 into 1 multiplexer and signal conditioning module for use with a broad range of transducers, instruments and other low level signals. The EXP-RES also provides excitation (voltage and current) for RTDs, strain gages and other transducers based upon precision bridge measurement techniques. MUX placement (after the amplification stage) is such that current leakage from the MUX has no affect on signal integrity. The EXP-RES was primarily designed for use with MetraByte's PCbus compatible DAS-8, DAS-16, and DAS-20 as well as our VMEbus compatible VMECAI-16 but may be used with any analog input board from any manufacturer or as a stand-alone signal preamplifier/multiplexer. The EXP-RES is configured as 8 differential, bipolar input channels with jumper-selectable gains of 1, 10, 100, and 200 on a per channel basis (2.5, 25, 250, or 500 using the x2.5 board level jumper). Up to 64 analog signals (56 thermocouples w/ CJC) may be cascaded into a single 8 channel analog input board. Support for 2, 3, and 4-wire RTDs (DIN and SAMA standards), 1/4, 1/2 and full bridge strain gages, and J, K, T, R, S, B, and E type thermocouples is standard. Each input channel is provided with a 1mA precision current source (for current excited transducers) and a 0.5, 1.0, 2.0, and 4.0 volt precision reference voltage. Signal input to the EXP-RES is easily accomplished using either the on-board screw terminals or via the (MetraByte) Screw Terminal Accessory panels (STA-08, STA-16, STA-20).

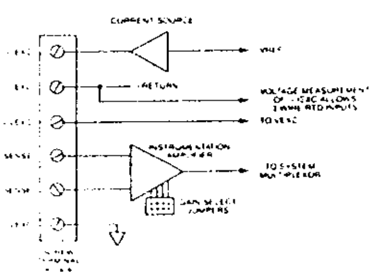
Software is provided with the EXP-RES assuring immediate access to full board functionality. Examples and mergable subroutines are included for use with the DAS-8, DAS-16 and the DAS-20 for linearizing thermocouples, using multiple EXP-RES's, using RTDs, etc. If custom programming is required, each channel on every EXP-RES is easily accessed via a simple, 3-bit TTL/CMOS compatible address code.

FEATURES

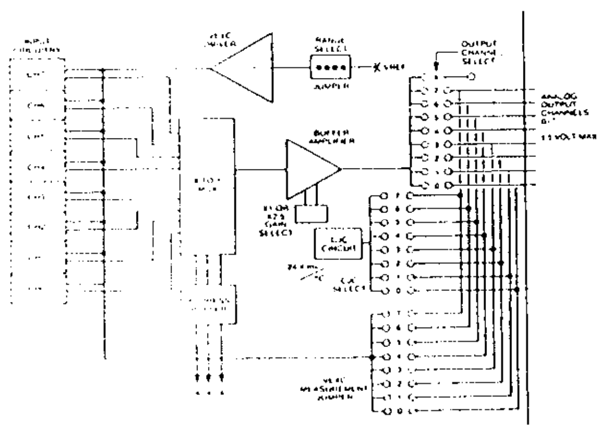
* Compatible with DAS-8, DAS-16, DAS-20, VMECAI-16
* Transducer excitation (voltage and current) provided
* Supports J, K, T, R, S, B, and E Thermocouples (w/ CJC)
* Supports 2, 3, and 4 wire RTDs (DIN and SAMA)
* Supports 1/4, 1/2, and Full Bridge Strain Gages
* Signal Conditioning with Multiple Gain Selection
* Software included

Block Diagram

Each Input Channel

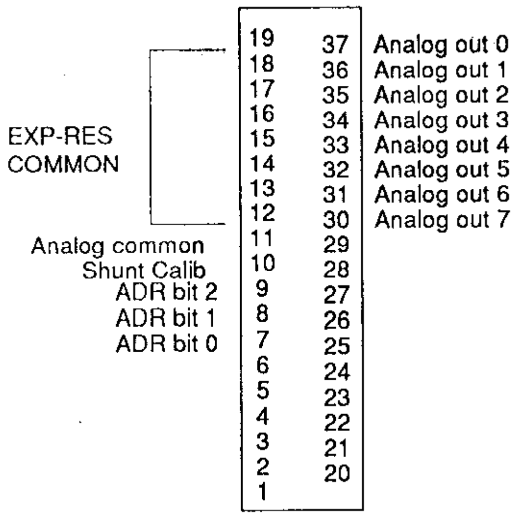


Main Board



2.0 HARDWARE SECTION

2.1 Connectors J1 & J2 Pinout



J1 & J2

2.2 Accessories, Cables & Compatibility

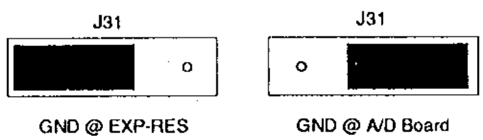
The EXP-RES may be operated from MetraByte's DAS-8, DAS-16, DAS-20 or VMECAI-16 Analog Input Boards as well as any other 8/16 channel A/D board from any manufacturer (see Power Supplies & Ground Return section for wiring). When used with an 8/16 channel A/D board (including the **DAS-16**, **DAS-20**, and **VMECAI-16**) the A/D board must be set for **single-ended input**. Input signals are made directly to the EXP-RES via the screw terminals on the board or via one of MetraByte's Screw Terminal Accessory boards (which also provide for auxiliary power input). The following cables should be ordered for the indicated useage:

MetraByte Board	**Interconnect Cable**
DAS-8	C-1800
DAS-16	S-1600
DAS-20	CEXP-2000
VMECAI-16	CEXP-2000
STA-08	C-1000
STA-16	S-1600
STA-20	CEXP-2000
Cascaded EXP-RESs	C-1000

2.3 Power Supplies & Ground Return

The EXP-RES may be powered directly from the computer supplies via the DAS-8, DAS-16, DAS-20, or VMECAI-16. When using multiple EXP-RESs, an auxiliary supply may be required since the computer supplies are limited. Each EXP-RES can draw as much as 700 mA (max) @ +5 Vdc. An auxiliary supply delivering +5 Vdc (such as MetraByte's PWR-55 or PWR-100) may be connected between pin 29 (+5 Vdc) and pin 11 (common) of connector J1 (MetraByte's Screw Terminal Accessory boards provide auxiliary power input connections). Additionally, if +10 Vdc bridge excitation is required (see section 3.8), an external +12 Vdc @ 350 mA may be connected between +VEXT and -VEXT of screw terminal TB5 (on the EXP-RES) and Switch S1 placed in the VEXT position. **NOTE: Caution should be used when powering multiple EXP-RESs from your computer supplies. Overloading these supplies may cause damage!**

When used with any of the MetraByte A/D boards mentioned above, the Analog Ground and LL (digital) ground should be connected at the A/D board. This is accomplished with jumper J31 (below). If using the EXP-RES as a stand-alone (no A/D board) the Analog ground and LL ground should be connected at the EXP-RES. The drawing below illustrates placement of jumper J31 for both modes of operation.

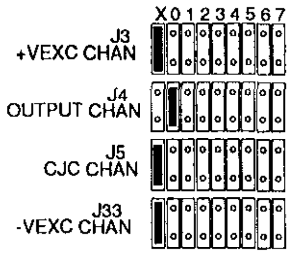


2.4 Cascading Multiple EXP-RES's

A maximum of 8 EXP-RES boards may be cascaded to a single 8 channel A/D board forming 64 analog input channels (56 w/ CJC). This is done by daisy-chaining the boards using the parallel connectors J1 and J2 and as many (MetraByte P/N C-1000) cables as required. NOTE that when several EXP-RES are daisy-chained together, an auxiliary power supply may be required (see section 2.3). If CJC, +VEXC, or -VEXC are used, the maximum number of available channels will decrease proportionally.

2.5 Output Channel Selection Matrix

The 8 input channels of the EXP-RES must be assigned a single output channel. This is accomplished via jumper J4. Simply place the jumper over the Output Channel # desired. Note that the Output Channel of the EXP-RES must match the input channel of the A/D board being used and that no two EXP-RESs connected to the same A/D board can use the same Output Channel i.e., each EXP-RES connected to the same A/D board must have a distinct output channel. The diagram below illustrates the Jumper matrix J3, J4, J5, and J33.



NOTE: *When using the EXP-RES with either the DAS-16, DAS-20, or the VMECAI-16, they must be configured for single-ended mode of operation.*

2.6 Gain Selection

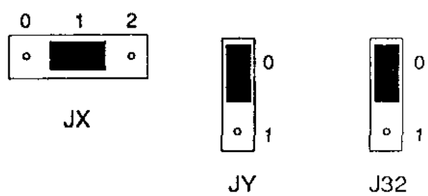
Each EXP-RES channel may be configured for a seperate input gain. This allows "fine-tuning" of the input channel for each signal. In addition, each EXP-RES may employ a x1 or x2.5 board multiplier resulting in a total of eight different gain choices:.1, 2.5, 10, 25, 100, 200, 250, and 500. The gain you choose will be a reflection of the signal level or transducer being used (see the section 3.0 for suggested gain for several common transducers). The x1 or x2.5 board gain is set using jumper J32 (as shown), while the individual channel gain is set according to the chart shown below:

Channel Assignment Chart

Ch#	JX	JY
0	J23	J15
1	J24	J16
2	J27	J19
3	J28	J20
4	J25	J17
5	J26	J18
6	J29	J21
7	J30	J22

Configuration Chart

GAIN	JX	JY	J32
X1	0	0	0
X2.5	0	0	1
X10	2	0	0
X25	2	0	1
X100	1	0	0
X200	0	1	0
X250	1	0	1
X500	0	1	1



2.7 EXP-RES Input Channel Selection

The eight channels of the EXP-RES are selected via a 3-bit TTL/CMOS address code (pins 9, 8, and 7 of J1) corresponding to three digital output bits from the various A/D compatible boards (DAS-8, DAS-16, DAS-20, VMECAI-16). The address code is straight binary as shown below:

A2	A1	A0	EXP-RES Input Channel
0	0	0	CH0
0	0	1	CH1
0	1	0	CH2
0	1	1	CH3
1	0	0	CH4
1	0	1	CH5
1	1	0	CH6
1	1	1	CH7

	3-bit Address Code			
	DAS-8	**DAS-16**	**DAS-20**	**VMECAI-16**
A2 =	OP3	OP2	DOUT 2	DOUT 2
A1 =	OP2	OP1	DOUT 1	DOUT 1
A0 =	OP1	OP0	DOUT 0	DOUT 0

See also the example program in the section 4.0 for implementation.

2.8 Output Signal Filtering

The EXP-RES allows filtering/smoothing of output signals after amplification, if desired. Filtering may be required if electrical noise is evident in the signal after amplification. **NOTE: Filtering will slow response time considerably and should not be used for output signals with frequencies greater than 100 Hz.**

Through-holes are provided on the EXP-RES for installation of two capacitors per channel. We recommended the use of 0.01 uF metal film capacitors. The chart below shows the capacitor assignments for the corresponding output channel:

EXP-RES Channel	Assigned Holes for 0.01 uF Caps	Location
0	C36,C37	Near U6
1	C38,C39	Near U7
2	C44,C45	Near U10
3	C46,C47	Near U11
4	C40,C41	Near U 8
5	C42,C43	Near U 9
6	C48,C49	Near U12
7	C50,C51	Near U13

3.0 APPLICATIONS

Each channel on the EXP-RES may be configured for signal inputs from 2, 3, and 4-wire devices via jumpers (section 3.5) on the board. Each of these input types require (internal) signal routing from the +SNSE, -SNSE, +IEXC, -IEXC, +VEXC, and -VEXC screw terminals to the various pins of connectors J1/J2.

3.1 Thermocouples & Suggested Gain

The EXP-RES supports all the common thermocouple types including J, K, T, R, S, B, and E. Gain selection is accomplished on a per channel basis and therefore allows mixing of thermocouples and other high and low level analog signals on the same board. The suggested gain for each type of thermocouple is shown in the chart below and is based upon the full range temperature span for each thermocouple type as given by the National Bureau of Standards (NBS) "mV vs Temp" table. Many application do not use the entire temperature range, but operate within a very narrow temperature band. This allows the user to "fine tune" the input channel to the thermocouple output for this reduced range and employ a simple linear interpolation method for conversion to temperature. This linear interpolation (slope) method often results in greater accuracy over a restricted range than is otherwise possible. The chart below shows each thermocouple type and suggested gain for each type.

T-couple Type	GAIN	Settling Time
E	x 100	350 uSec
J,K	x 200	350 uSec
S,T,R,B	x 500	350 uSec

3.2 CJC Output Channel Selection and Floating Inputs

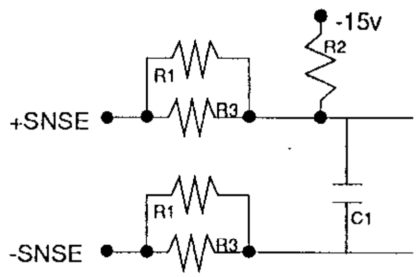
Built-in CJC circuitry is provided producing 24.4 mV per Deg C (0.1 Deg C/bit) with 0.0 Volts @ 0 Deg C. As such, the EXP-RES should be protected from draughts and direct sunlight in order to accurately reflect room temperature. The CJC signal may be routed to any unused EXP-RES output channel (via jumper J5) where it can be measured by the A/D board and software compensation accomplished. NOTE that the CJC output channel must be a distinct, unused channel to avoid signal conflicts and erroneous results. If CJC is not used, jumper J5 should be placed in the "X" position.

Since a thermocouple is a floating (non-ground referenced) voltage source, the EXP-RES low input leg (-SNSE) must be referenced to ground. **NOTE: The channel being used for thermocouple input should be configured for a 2-wire input device (see section 3.5). Failure to do so may result in erroneous readings.** Referencing the low (-) thermocouple input side to ground is easily done by connecting a wire (jumper) between the **-SNSE** terminal and the **-IEXC** terminal for the selected channel.

3.3 Open Thermocouple Detect and Input Filtering

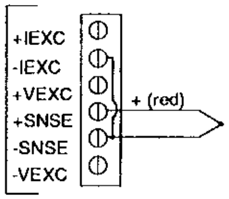
OPEN thermocouple detection and input filtering are provided on the EXP-RES by installing 3 resistors and a capacitor on the desired input channel(s). In addition, two 0 ohm resistors must be removed or cut. Once installed, these biasing resistors will slowly pull an OPEN input channel to -5Vdc. This -5Vdc condition can be sensed and flagged in software. NOTE that the low side of the thermocouple must be referenced to ground (see section 3.2 for details). The following table and diagrams should be used when configuring inputs for open channel detection and input signal filtering.

Ch #	R1 (10K) (install)	R2 (100M) (install)	R3 (0K) (remove)	C1 (1uF) (install)
0	RX3,RX6	RX7	R114,R115	CX1
1	RX9,RX11	RX8	R116,R117	CX2
2	RX14,RX16	RX13	R118,R119	CX3
3	RX19,RX21	RX18	R120,R121	CX4
4	RX29,RX30	RX32	R122,R123	CX5
5	RX33,RX35	RX37	R124,R125	CX6
6	RX38,RX40	RX42	R126,R127	CX7
7	RX43,RX45	RX47	R128,R129	CX8



3.4 Thermocouple Wiring Diagram

Wiring any thermocouple to the EXP-RES is simply a matter of wiring the positive side of the device (international color code dictates the RED leg is positive) to the +SNSE terminal and the negative side to the -SNSE terminal of the desired input channel. Note that the diagram below also shows the ground reference wire connected between **-SNSE** and **-IEXC** terminals. The channel has been configured as a 2-wire input device (via J7-J14).

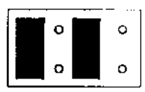


Thermocouple Input

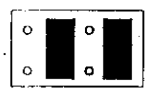
3.5 RTDs and Other 2, 3, and 4-Wire Devices

The EXP-RES provides 1 mA excitation for 2, 3, and 4-wire RTDs. Example programs supporting both DIN and SAMA standards are provided on the accompanying diskette. Each of the above RTD types require different wiring and board configurations. Suggested gain for RTDs is x 25 (section 2.6). The table below with accompanying jumper diagram will aid in the setup of the EXP-RES channels for various RTD inputs.

Channel #	Jumper
0	J7
1	J8
2	J11
3	J12
4	J9
5	J10
6	J13
7	J14



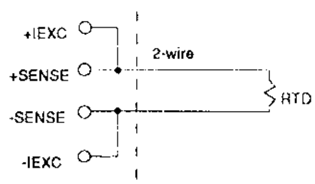
2 & 4-Wire Devices
or
Bridge Measurements

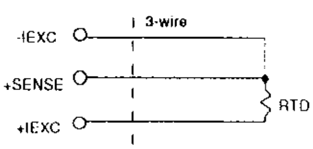


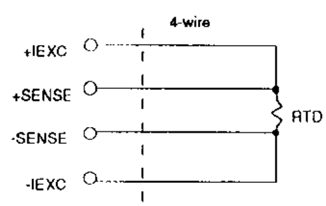
3-Wire Devices

3.6 RTD Wiring Diagrams

The wiring diagrams below should be followed for the various RTD or RTD-based transducers you are using.







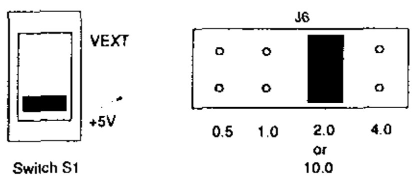
3.7 Bridge Measurements

The EXP-RES supports a number of transducers based upon resistance bridge measurement techniques (Strain Gages, etc.). This is an extremely accurate method of determining unknown resistance values and is therefore quite popular for precision transducers based upon change in resistance with respect to physical parameters (temperature, pressure, strain, etc.). Essentially, bridge measurement techniques consist of substituting an unknown resistance into one or more legs of a full bridge of known values. As you would expect, this technique requires excitation (voltage) which is provided on the EXP-RES.

Bridge measurements normally require ground loop compensation due to the potential difference between excitation voltage ground and measurement system ground (excitation voltage ground carries greater current). This difference is easily measured by routing the excitation voltage low (-VEXC) to an EXP-RES output channel (jumper block J33) and reading the value with the A/D board being used. The value may then be added to the measured bridge value as a ground loop compensation factor. The EXP-RES also has provisions for monitoring the bridge excitation voltage by placing a jumper over the desired +VEXC output channel using J3 (see section 2.5). This may be used as a check on the excitation voltage level for precise measurements. If neither of these signals are used, both jumpers should be placed in the "X" position.

3.8 Bridge Completion & Excitation

Provisions for bridge completion and excitation have been made on the EXP-RES. Excitation voltages of 0.5, 1.0, 2.0, and 4.0 volts are provided without the need for an external power supply. 10 Vdc excitation requires the use an external +12 Vdc (@ 350 mA, min) supply. If an external +12 Vdc supply is used, the +5V/VEXT switch must be in the VEXT position. The external supply is connected between the +VEXT and -VEXT terminals of connector TB5. Jumper J6 is used to select the various excitation voltages.



Bridge completion may be done either on the EXP-RES itself or remote from it, if desired. Configurations using remote bridge completion resistors require only that the EXP-RES be configured for Bridge Measurements (via jumpers J7-J14) and that signals and excitation be wired as shown in section 3.9.

When configuring the EXP-RES for on-board bridge completion, the two user installed resistors RX23 and RX24 can form half the bridge for any or all of the 8 channels by wiring the +VEXC, -VEXC, and +SNSE channel terminals to the +VEXC, -VEXC, and +SNSE board terminals (TB5), respectively (section 3.9). Once this has been done, the other half of the bridge is formed by installing a single resistor at the location shown in the table below. Again, the EXP-RES must be configured for Bridge Measurements via jumpers J7-J14 (section 3.5).

Bridge Completion Resistor Placement Table

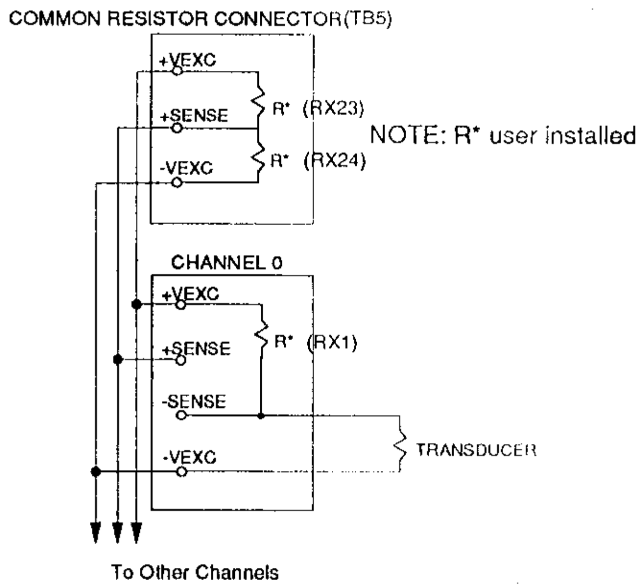
EXP-RES Channel	Bridge Completion Resistor
0	RX1
1	RX2
2	RX50
3	RX51
4	RX26
5	RX27
6	RX48
7	RX49

NOTE: Through-holes are sized for standard S-type, wire-wound, and hermetic type resistors.

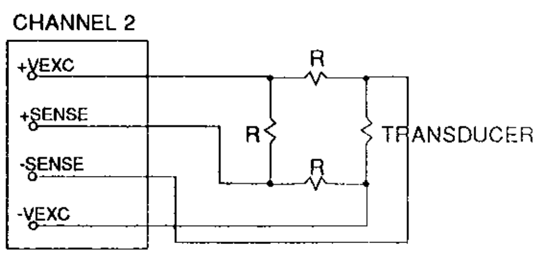
3.9 Bridge Wiring Diagrams

The following wiring diagrams show both methods of connecting resistors to the EXP-RES. As illustrated, several channels may be connected in parallel using the same COMMON RESISTOR CONNECTOR (TB5) when Bridge Completion Resistors are mounted on the EXP-RES.

Bridge Completion Resistors Located on the EXP-RES



Bridge Completion Resistors Located Remote from EXP-RES



4.0 SOFTWARE

The EXP-RES comes complete with several BASIC programs and subroutines designed to help users become familiar with the board and its various callable routines. These routines are designed for use in conjunction with MetraByte's DAS-8, DAS-16, and DAS-20. There is also an 680X0 assembly language program given in this section that will aid VMECAI-16 users.

This Section is intended as a primer for EXP-RES users and, as such, it is assumes familiarity with one of the A/D boards listed above and associated programming.

4.1 EXP-RES Input Channel Selection Using the DAS-8

EXP-RES input channel selection using the DAS-8 is accomplished via a "MODE 14" call routine. Upon execution of a MODE 14 call OP0, OP1, and OP2 are latched and DAS-8 conversions are performed on the latched channel. Subsequent EXP-RES channels may be accessed by repeated MODE 14 calls. The most convenient method of scanning the 8 EXP-RES channels is by use of a "FOR ... NEXT" loop as follows:

```
xxx10  DIM DIO%(16)
xxx20  MD%=1:LT%(0)=1:LT.%(1)=1            'Select DAS-8 input channel.
xxx30  CALL DASH8(MD%,LT.%(0),FLAG%)       'Call Mode 1 routine.
xxx40  FOR I=0 TO 7                        'EXP-RES loop counter.
xxx50  MD%=14:OP%=I                        'Mode 14; Adr Bits set to I.
xxx60  CALL DASH8(MD%,OP%,FLAG%)           'Call Mode 4; EXP-RES CH select.
xxx70  MD%=4                               'Set MODE 4.
xxx80  CALL DASH8(MD%,DIO%(I),FLAG%)       'Do A/D conversion.
xxx90  NEXT I                              'Select next Ch, check for end
```

Following this procedure, the data from channel 0 will be in DIO%(0), channel 1 in DIO%(1), etc. If another EXP-RES is scanned, the same procedure may be used selecting a different DAS-8 input channel. Nested "FOR...NEXT" loops are quite efficient for scanning multiple EXP-RES's.

4.2 Transducer Routines

Transducers generating low level (mV, mA, etc.) signals such as thermocouples, strain gage bridges (including load cells, pressure and force transducers, etc.) require significant amplification prior to A/D conversion from high level A/D boards including MetraByte's DAS-8, DAS16, DAS-20 and VMECAI-16. The EXP-RES accomplishes this signal conditioning by use of a highly stable instrumentation amplifier. For thermocouples, CJC circuitry is also provided. With it's built-in excitation capability (both current and voltage), the EXP-RES is capable of handling interface requirements for a very broad range of DC output tranducers.

The diskette supplied with the EXP-RES contains several programs complete with device drivers for using the EXP-RES with RTD's and common thermocouples. Seperate programs are supplied for the DAS-8, DAS-16, and DAS-20. These routines are stored in ASCII format for easy incorporation into your own BASIC programs. Each routine consists of a data subroutine starting at line 50000 and a linear interpolation subroutine starting at line 51000. After initializing the A/D card, the data section should be GOSUBed. This loads a data look-up table into RAM (be patient, it may a few secomds)..The linearization subroutine can be GOSUBed as often as required. This method is both fast and accurate over the entire temperature range (interpolation is done between two adjacent table values) supported by the various thermocouples. To avoid error messages, data should be bounded to physically realisable temperature values prior to entering the various subroutines.

The RTD examples are stand alone programs for use with the DAS-8, DAS-16(F), and the DAS-20. Each program contains routines which may be lifted from the programs and merged into your own BASIC programs. They are heavily commented and list beginning and end points for each of the various sections. The ER-(?).BAS files are examples using the DAS-8 and EXP-RES with several different thermocouple types.

4.3 Supplied Programs for the EXP-RES

The following programs are supplied on the EXP-RES diskette:

ONE-ER.BAS	DAS-8 example using 1 EXP-RS.
MANY-ER.BAS	DAS-8 example using 3 EXP-RES's.
ER-J thru R.BAS	DAS-8 examples for each of the thermocouple types.
J.BAS - R.BAS	Thermocouple linearization routines.
D08-DRTD.BAS	DAS-8 example using EXP-RES with DIN type RTD.
D08-SRTD.BAS	DAS-8 example using EXP-RES with SAMA type RTD.
D20-DRTD.BAS	DAS-20 example using EXP-RES with DIN type RTD.
D20-SRTD.BAS	DAS-20 example using EXP-RES with SAMA type RTD.
D16-DRTD.BAS	DAS-16 example using EXP-RES with DIN type RTD.
D16-SRTD.BAS	DAS-16 example using EXP-RES with SAMA type RTD.

5.0 CALIBRATION

Every EXP-RES is tested and precalibrated prior to shipment. Physical parameters such as component aging, computer supply voltage variations, and normal amplifier drift all contribute to the need for periodic recalibration. Recalibrating the EXP-RES is a simple procedure requiring little time and effort and should be done periodically to maintin the high degree of accuracy that you have come to expect from the board. Recalibration intervals vary widely as a result of the environment surrounding the EXP-RES. When subjected to large thermal gradients, high humidity, and/or excessive vibration, recalibration every 3 months may be necessary. For laboratory, office, and other stable environment usage, calibration intervals of 6 months to 1 year are normally adequate.

Calibration should be done under actual usage conditions and board configuration (including gain) for the channel being calibrated.

Required Equipment:

4 1/2 Digit DVM
Accurate, noise-free DC voltage reference source
Accurate Digital thermometer (+/- 2 deg C)
Small slot-head screwdriver or potentiometer trimmer.

Procedure: Channel Zero Adjust

1. Configure the EXP-RES for daily operation (measurement type and gain).

2. 2 & 4-wire device configurations require +SNSE, -SNSE, and -IEXC terminals be wired together. 3-wire device configurations require +SNSE and +IEXC terminals be wired together.

3. Power the EXP-RES (via A/D board or independantly as described earlier).

4. Select the A/D board input channel corresponding to the EXP-RES output channel to be calibrated.

5. Connect the low (-) side of the DVM to any -IEXC channel terminal and the high (+) side of the DVM to one of the jumper pins on the upper side of the OUTPUT CHAN jumper connector.

6. Adjust the potentiometer corresponding to the channel being calibrated for best 0 Vdc reading on the DVM.
   The table below shows the data channels and associated potentiometer.

EXP-RES Channel	**Potentiometer**
CH 0	R19
CH 1	R20
CH 2	R21
CH 3	R22
CH 4	R74
CH 5	R75
CH 6	R104
CH 7	R105

Procedure: CJC Calibration

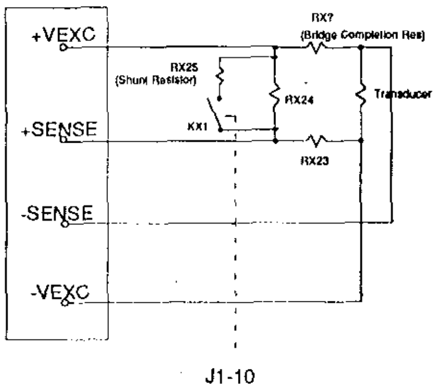
1. Connect the DVM from EXP-RES common to one of the jumper pins on J3.
2. Read the temperature from a Digital thermometer placed near VR1 on the EXP-RES.
3. Adjust R30 (CJC Adj Pot) until a stable reading of 24.4 mV per deg C is attained. For example a reading of 17.7 deg C will yield 0.4148 volts.

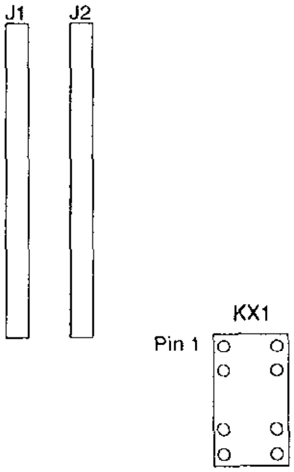
Procedure: Optional Shunt Calibration

The EXP-RES provides shunt calibration via a user installed relay (KX1, Douglas-Randall Model# 5D1C: MetraByte P/N 17103) and a precision shunt calibration resistor (RX25, available from Vishay, Inc. Cat. #A110, pg 32-33). Holes have been provided on the EXP-RES for both of these components. The relay is activated by a TTL high signal on pin 10 of connector J1 and, when enabled (closed), RX25 will shunt RX24. This will change the bridge resistance with subsequent change in measured voltage across +SENSE and -SENSE. When read, this proportional change in bridge resistance and voltage drop can be used to provide a software correction factor for the bridge.

The diagrams below show KX1 orientation and wiring for the shunt and relay.

SHUNT CALIBRATION





Procedure: Bridge Voltage Excitation Calibration

1. Configure J6 for bridge measurements and switch S1 for desired excitation voltage (see section 3.8).

2. Connect the low side of the DVM to -VEXC terminal of TB5. Connect the high side to +VEXC terminal of TB5.

3. Adjust the potentiometer corresponding to the voltage excitation used.

Bridge Excitation	Potentiometer
0.5 Volts	R1
1.0 Volts	R2
2.0 or 10.0 Volts	R3
4.0 Volts	R4

Procedure: Current Source Excitation Calibration

1. Set DVM for current measurements and connect it between -IEXC and +IEXC of the channel to be calibrated.

2. Adjust the potentiometer corresponding to the channel to be calibrated for 1 mA.

EXP-RES Channel	Potentiometer
CH 0	R13
CH 1	R11
CH 2	R25
CH 3	R27
CH 4	R69
CH 5	R71
CH 6	R108
CH 7	R110

EXP-RES SPECIFICATIONS

Instrumentation Amplifier

Gain	1,10,100,200 or 2.5,25,250, and 500 (Jumper selectable per channel)
Input Offset Drift	15 uV/deg C (gain x1,x2.5) 6 uV/deg C (gain x25,x10) 5.1 uV/deg C (gain x100,x250)
Common Mode Rejection	100 db (gain x10,x25,x100,x250) 94 db (gain x1,x2.5)
Non-linearity	0.075% (gain x100,x250) 0.045% (gain x1,x2.5,x10,x25)
MUX Settling Time	350uSec (gain x100,x250) 35uSec (gain x10,x25) 3.5uSec (gain x1,x2.5)
Gain TempCo	20 ppm (gain x100,x250) 15 ppm (gain x10,x25) 10 ppm (gain x1,x2.5)
Thermocouples Supported	J, K, T, E, S, R, B
Cold Junction Compensation	24.4 mV/deg C (0.1 deg C/bit)
Input Bias Current	5 nA (typ); 20 nA (max)

Overvoltage Protection

Common Mode	+/- 10 Vdc
Analog Output Voltage	+/- 5 Vdc (max)
Analog Output Current	10 mA (max)

Excitation Current Source

Number of sources	8
Excitation Current	1 mA
Accuracy	Better than 0.1%
Compliance	0 to 2 Vdc

Voltage Excitation Source

Range	0 to 4 Vdc (Adjustable) 10 Vdc (w/ External Supply)
Current	350 mA (current limited)

Power Requirements

+ 5Vdc @ 1.0 Amps (typ); 1.4 Amps (max)

Physical

Dimensions	16 x 4.75 in (40.63 x 12.06 cm)
Screw Terminal size	Accepts 12 - 22 awg

Environmental

Operting Temperature	0 to 60 deg C
Storage Temp	-40 to +100 deg C
Humidity	0 to 90% non-condensing