A/D Calibrations

Introduction

The A/D can be configured as a voltage input unit, or as a voltage and isolated current input unit, dependent on the modules installed. In both types, the analog section of the A/D is optically separated from the digital section and other parts of the CPP. This provides an electrically quiet operating environment for the low level analog signals. To convert a channel into and isolated channel, an isolated converter module is plugged into a connector provided for each channel.

Switches

Dip switches SW1-SW4 are used to select the analog full scale of each channel. SW5 is used to select either single ended or differential inputs. An 8 position DIP switch, SW6, is used to configure the A/D board to respond as either A/D #1 or A/D #2. The switch settings are given below.

SW1-SW4 Chn Full Scale	SW5 Single	SW5 Diff	SW6 A/D #1	SW6 A/D #2
1 Ch1 5v	1 On	1 Off	1 On	1 Off
2 Ch1 10v	2 ON	2 Off	2 On	2 Off
3 Ch2 5v	3 Off	3 On	3 Off	3 On
4 Ch2 10v	4 Off	4 On	4 Off	4 On
5 Ch3 5v			5 On	5 On
6 Ch3 10v			6	6
7 Ch4 5v			7 60Hz	7 60Hz
8 Ch4 10v			8 50Hz	5 50Hz

Calibration

The firmware in the CPP also supports a calibration for the analog to digital converter. Each A/D PC board has an on board EEPROM for storing the calibration results. The A/D calibration is started by entering AD_CALx, where x is either a 1 or a 2 indicating which board is to be calibrated. If the x is omitted, the CPP asks for the board number. The CPP then presents the following table. Inputting a number selects a starting point.

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1 = Zero
2 = 1v Span
3 = 5v Span
4 = 10v Span
5 = Serial #
Choice =
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Before making a setup selection, do the following.

First - Connect a voltmeter across J?? pins 1 & 3. Adjust potentiometer R?? for a reading of 0.515 volts.

Next - Plug in the connector that connects all positive inputs together and all

minus inputs together.

Next - Install a jumper across J?? pins 1 & 2 to enable the write to the on board EEPROM.

Next - Although it is not required, it is a good procedure to write a set of ideal default parameters into the EEPROM. This is done by inputting AD_Ew<cr>. The CPP responds with a statement that this command overwrites any stored information in the EEPROM. Type a Y to proceed. If the default parameters are stored properly, the CPP returns a > prompt. Otherwise, an error message is returned.

Next – Make sure that the date in the CPP is correct.

Next - Enter AD_CALx<cr>, and enter a 1 to select a zero calibration.

1 = Zero

Selecting 1 commands the CPP to calibrate the voltage of the A/D. The CPP responds with

> Ground All Inputs – Ret When Ready

The Ret is a carriage return. Inputting an escape character aborts the calibration. After applying 0v and inputting a carriage return, the CPP samples each channel two times and averages the samples to arrive at the zero value. The CPP checks each calculated value against an allowed delta, and prints an excessive drift message and aborts the calibration if the delta is exceeded. The CPP allows a delta of 10 counts out of 4000 for the zero value. If all values are in range, the CPP prints the results and proceeds to the next step – Input 1v – Ret When Ready. Inputting an escape exits the calibration routine.

2 = 1v Span

This follows the zero calibration, or can be selected from the table by inputting a 2. The system responds with

> Input 1v – Ret When Ready

The following procedure is the same a described above for a zero calibration. The CPP allows a delta of 150 counts out of 4000 for the 1v full scale reading. The CPP computes the scale factor (SF) for each channel as follows;

$$SF = (Full\ Scale)/(Actual\ Full\ Scale\ Reading – Actual\ Zero\ Value)$$

3 = 5v Span & 4 = 10v Span

These are computed in the same fashion as the 1v range described above, except that the gain selection switches must be set for the 5v and 10v calibrations, respectively.

4-20mA Calibrations

No calibration is required for an isolated 4-20mA input. The channel should be set to the one volt range, and an isolated converter module installed. The isolated module is adjusted at the factory to provide a 0.2 to 1.0 volt output signal. At the end of a calibration, based on the zero and 1v calibrations, the CPP calculates the offset and gain constants for the 4-20mA inputs.

Serial #
After the calibration is completed the CPP asks for the serial number of the A/D board. The CPP will not proceed until a serial number has been input. The serial number must consist of four numbers, *e.g.,* 0020. The Unit then asks for your initials. The CPP records the serial number, and the initials in the onboard EEPROM along with the CPP clock – month and year.

Print Out EEPROM
The contents of the EEPROM can be printed out with the following command;

       AD_EP<cr>

Following a calibration, the EEPROM values should be printed out, signed and stored with the CPP unit documentation.

Write Enable To EEPROM
Upon exiting the calibration, the CPP will print a reminder to remove the write enable jumper J?? to the EEPROM.

Data Correction
Each channel in the A/D has a stored reading for a zero value and a stored value for each input signal range. Every time a channel is digitized, the reading from the A/D is corrected for any zero offset that may be associated with the channel, and then scaled by the scale factor calculated and stored for this channel and this range. This is done as follows;

       Data Point = (Reading – Zero Offset)(Scale Factor)*