

Description

The MicroAnalog2 auto zero module adds auto balance capability to the microanalog 2 system. It provides an auto zero control for all the FE-366-TA modules fitted to the rack based on a single pushbutton action. (pushbutton contacts are also available on the multiway connector at the rear of the rack to allow remote equipment to initiate the auto-zero.) When the push button is operated, the module looks at the analogue output of each module and applies an offset signal to drive that output to 0 V. The module features non-volatile storage so that offsets are retained during power down. The auto-zero has an averaging capability to allow auto-zeroing to take place when time varying signals are present on the channels being zeroed.

Specification

Controls	AZ Pushbutton	Pushbutton mounted on front edge of card.
	Remote AZ	Opto-isolated signal from remote equipment.
Jumpers	System Select	Selects the FE-MM8, FE-MM16, or FE-MM40 system.
	Write Protect	When present the system does not overwrite the offsets stored in Non-Volatile memory.
	Max Channels.	Jumper area which defines the number of channels to be auto-zeroed.
Indicators	Auto-Zero in progress	Front panel LED is illuminated (Red) while auto-zero is in progress.
Operating Time	(for 40 channels)	45 seconds maximum.
Averaging Capability		Unaffected by 50 Hz 1 V pk-pk outputs.
Environment	Temp. Range	0°C to 50°C operating
Physical	Card size	7" x 2.65". 2U high format (180 mm x 67 mm).

FE-366-AZ Specification

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1 Auto Zero System Introduction

When any bridge amplifier such as the FE-366-TA transducer amplifier is used with a bridge transducer, its output depends upon the "balance" of the bridge transducer. In general any transducer installation will not be ideally balanced in the datum position, and consequently the output of the amplifier will not be zero (0 V). The signal with the transducer in the datum position has to be subtracted from all subsequent measurements by the data acquisition system, and this may reduce the effective range and resolution of the system. It is therefore useful to have a means of setting the bridge amplifier output to zero when the transducer is at the datum position.

The FE-366-TA provides a "shunt balance control" which puts the resistance of a potentiometer in parallel with the bridge arms to allow the user to force the amplifier inputs to become equal, and thus make the output of the amplifier zero. This is not always desirable, since it involves manually adjusting a potentiometer while looking at the amplifier output, and can be a time consuming task for a system comprising many channels. Also not every transducer arrangement can be balanced in this way.

An auto zero system does not attempt to make the inputs of the amplifier equal, but instead calculates and applies an offset correction to make the amplifier output zero (0 V) on command from the user. It then maintains the offset so that the data acquisition system can be assured that subsequent measurements are based on amplifier outputs at zero (0 V) with transducers at their datum positions.

2 FE-366-AZ Auto Zero System Description

The FE-366-AZ module can be used to provide an auto zero function for up to 20 FE-366-TA modules.

The Auto Zero Option uses an enable control to allow each channel's output to be seen by the FE-366-AZ Auto Zero module, and to allow each channel to receive an Auto Zero correction. Each channel's enable control is generated by digital circuit elements on the FE-366-AZ Auto Zero module and on the system backplane. These circuit elements allow the FE-366-AZ Auto Zero module to look at the output of one channel at a time and to provide an offset correction to the channel.

The FE-366-AZ Auto Zero module regularly enables each channel and refreshes each FE-366-TA Transducer Amplifier module with the offset correction. The FE-366-TA module includes a capacitor and buffer for each channel which stores the offset correction until the channel is next refreshed.

The auto zero function can be initiated by pressing the front panel pushbutton or by applying an external +5 V signal at the rear panel connector. (Refer to the section on your enclosure for the pin out of this connector.) The auto-zero function causes the Auto Zero correction for each channel to be set such that the channel's output is 0 V. The FE-366-AZ Auto Zero Module stores all Auto Zero corrections for the channels and uses them to refresh the transducer amplifiers.

3 Installation

The FE-366-TA jumper to enable the Auto-Zero must be set. There are two of these jumpers (one for each channel) on the dual channel FE-366-TA. Each jumper is marked "Auto Zero In / Out". For a channel to operate with the auto-zero, the jumper must be set to the "In" position.

The jumper which matches the system type must be fitted on the FE-366-AZ module. These jumper positions are marked "FE-MM8", "FE-MM16", or "FE-MM40". Make sure that the jumper fitted matches your system.

The number of channels which you want to auto-zero must match the jumpers fitted to the "Max Channels" jumper area. For example if you want 12 channels to auto-zero you must fit jumpers "4" and "8" in the "Max Channels" jumpers area.

The FE-366-AZ module must be fitted in the slot nearest to the power supply. (Refer to the handbook for your enclosure for more details.)

For best performance, the FE-366-TA modules should be fitted in the lowest numbered slots (see 5.1 Performance Considerations).

4 Functional Verification

The FE-366-AZ Auto Zero Module has one red indicator on its front edge which is visible through the system front panel. The red indicator is illuminated continuously during the auto zero sequence.

Press and hold the front panel button. The front panel indicator illuminates for one second and then extinguishes.

Release the front panel button. The front panel indicator is now flashing to indicate "Auto-Zero-Out Mode". See section 5.3.

Press and hold the front panel button. The front panel indicator illuminates for one second and then extinguishes.

Release the front panel button. The front panel indicator remains extinguished to indicate normal operation.

After this sequence, the stored auto-zero values for each channel are unchanged.

5 Operating Instructions

The Auto Zero function may be initiated by depressing and immediately releasing the front panel pushbutton, or by applying a signal at the rear panel connector or using software and the USB interface.

While Auto Zero is in progress the red indicator illuminates. The Auto Zero operation takes approximately 1.2 seconds per channel, and starts with channel 1.

At the end of the sequence the channels which could be zeroed will have outputs within ± 3 mV of zero (0 V).

There are a number of reasons which for a channel output to fail to go to zero (0 V) during the Auto Zero sequence.

- (a) The channel's auto zero is disabled by the jumper on the FE-366-TA module.
- (b) The channel inputs are not correctly connected to a transducer.
- (c) The channel inputs are such that the ± 8 V offset range of the Auto-Zero correction cannot correct the output to zero. Reducing the gain of the FE-366-TA channel would help, but if the amplifier is trying to produce an output outside the ± 8 V range at unity gain, then the only solution is to reduce the differential input signal. (For resistive bridge transducers such as strain gauges, this can be achieved using the FE-366-TA balance control. Reducing the transducer supply from +10 V to +5 V may also help).
- (d) The channel inputs are changing significantly during the Auto Zero sequence, thus giving rise to an unwanted signal at the output during the sequence. The FE-366-AZ auto zero module is very good at handling channels which have up to 1 V pk-pk of unwanted signal ("noise") above 50 Hz at their output due to the auto-zeroing algorithm used. Up to 50 Hz noise should be kept below 100 mV pk-pk. In particular the user should be aware that both the transducer and the FE-366-TA Transducer Amplifier will have warm up drift, hence initiating the auto zero sequence soon after power up may not give the optimum result. For the FE-366-TA Transducer Amplifier, the output will be stable one minute after power is applied.

5.1 Performance Considerations

There is a jumper area on the FE-366-AZ Auto Zero Module which allows the user to choose the number of channels which are zeroed and refreshed. The jumper area is in the centre of the module and is labelled "Max Channels". It carries six jumpers labelled 1 to 32, and the number of channels refreshed and zeroed is determined by the total of the numbers selected by these jumpers. Although selecting the maximum number of 40 (by fitting jumpers 8 and 32) will allow every channel of a 40 channel system to be refreshed and zeroed, the cost is a long time for the zeroing sequence, and a longer refresh period for each channel. As a guide, the time for the zeroing sequence is about 1.2 seconds per channel, so if only 5 channels are being used, just fitting jumpers 4 and 1 will allow the sequence to complete much faster.

The effect of the refresh period on performance is normally difficult to discern, but small improvements in the stability of the output occur for the shorter refresh period which comes with the selection of a smaller number of channels. This is because the capacitor which holds the correction voltage is refreshed more frequently reducing any drift during the refresh period.

Note the channels refreshed and zeroed always start with channel 1 and stop with the number selected by "Max Channels". This means that if only a limited number of channels are selected to be zeroed and refreshed, then they must correspond to the modules fitted in the lowest numbered slots in the system. (i.e. at the left hand side viewed from the front.)

Beware of channels which have the auto-zero function enabled, but are not selected by the above jumpers. (See below : "Disabling Auto Zero"). The output of such channels will be unpredictable.

5.2 Auto Zero Out Control

It is sometimes useful to know the effect which the auto-zero correction is having on the FE-366-TA channel. If the auto-zero correction is removed (set to 0 V) the output then provides a true reflection of the state of the inputs to the module. The FE-366-AZ provides the user with an "Auto-Zero Out" facility. To set auto-zero "out", hold down the pushbutton for longer than one second. The indicator will illuminate and then extinguish while the button is pressed. After the indicator has extinguished, release the button. This causes the FE-366-AZ module to refresh every channel with 0 V instead of the correction signal. The front panel indicator is flashing to show that the module is not operating normally. To exit this mode,

press and hold the button again until the indicator is extinguished. Now release the button and the indicator remains extinguished indicating normal operation.

5.3 Disabling Auto Zero

Any channel which is not selected to be zeroed and refreshed according to 5.1 should have its auto zero option disabled. This is because when the "Max Channels" jumpers are set so that the channel is not being refreshed, the capacitor on the FE-366-TA module will pick up stray charge and affect the channel's output.

The FE-366-TA jumper to disable the Auto-Zero must be set. There are two of these jumpers (one for each channel) on the dual channel FE-366-TA. Each jumper is marked "Auto Zero In / Out". To disable the auto-zero for a channel,, the jumper must be set to the "Out" position.

5.4 Non Volatile Memory

Normally the system will restore the Auto Zero corrections when it is switched on. This is because when an Auto Zero Sequence is initiated, the FE-366-AZ Auto Zero Module stores the new Auto Zero corrections in non-volatile memory, however if the "No Store" jumper is fitted the new Auto Zero corrections will be lost when the system is switched off.

The Non-Volatile memory is limited to approximately 100,000 erase/write cycles, hence if long term operation with regular auto zero sequences is planned, it might be worth fitting the "No Store" jumper.