3-8. QAV

Analog Input Point
(Syle 7379A21G01 through G09)

3-8.1. Description

Groups 01through G09 are applicable for use in the CE MARK Certified System

The QAV card converts an analog field signal to digital data (see Figure 3-54). (For new applications, a QAX card is recommended). The digital data is the summation of a frequency that has been counted for a time period. The time period is a multiple of the power line frequency (50 or 60 Hz).

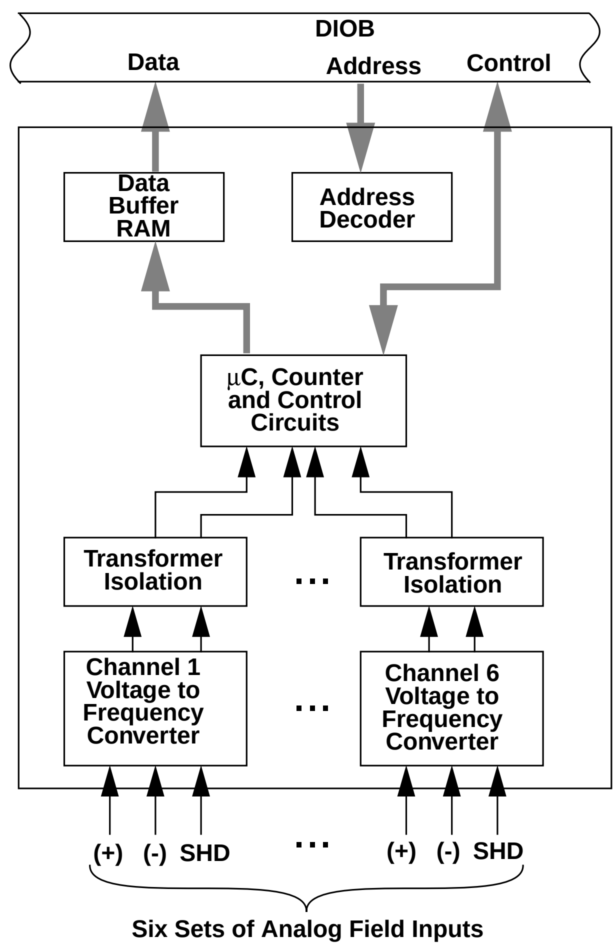

Figure 3-54. QAV Block Diagram

Each QAV card contains six individually isolated voltage-to-frequency converter circuits (channels). The output of each input circuit is processed by a common microcomputer and the resulting digital data is multiplexed to the Distributed Input/Output Bus (DIOB) as a 13-bit word.

Figure 3-55 shows a typical control system configuration using QAV cards. The QTB card is necessary for applications where large variations of power line frequency exist to obtain a high normal mode rejection. Up to 30 QAV cards (180 channels) can be used with one DIOB controller.

Cards equipped with the thermocouple temperature compensation feature use channel 6 for the on-card temperature sensor. The channel is read every time the card performs an auto-calibration cycle. The on-card temperature sensor eliminates the need for external sensor boards, and ensures field temperature accuracy.

The QAV card uses an electrical isolation circuit (transformer) to separate the analog input from the digital counting circuits. The isolation circuit provides power for each analog input channel in addition to precise timing from a stable frequency which is generated on the digital side of the QAV card circuits.

Each analog input circuit contains circuitry for signal conditioning, biasing, auto-zero and gain correction, open thermocouple detection (not available on G04 and G05 QAV cards) and a clocked voltage-to-frequency converter.

Offset and gain correction factors are calculated on a periodic basis by the QAV card microcomputer. The frequency of the offset and gain calibration cycle is determined by a constant which has been programmed into the memory of the system controller.

Two known potentials on the analog section of the QAV card are used as standards for offset and gain calibrations. One standard is a 0 VDC (shorted input), which is used to determine the offset correction factor. The second calibrating potential (gain) is derived from a separate, stable voltage reference which is set approximately –150% of the maximum expected analog input value. The gain correction factor is compared to a 16-bit calibration constant which is programmed into the memory of the system controller at the time of factory card calibration. The calibration constant is necessary because the QAV card has no mechanical adjusting devices (such as potentiometers, and so on). This method yields a trimmer (or pot) -less calibrating method.

3-8.2. Features

Each QAV card has the following features:

- IEEE surge withstand capability
- Auto zero, auto gain correction
- Electrical isolation on all channels
- On-card digital memory (buffer)
- Open thermocouple detection (This feature is not available on G04 and G05 QAV cards.)
- Common mode rejection
- Normal mode rejection
- Automatic reasonability test (shorted input)
- Auto-conversion check
- Jumper selectable 50/60 Hz operation
- On-card thermocouple temperature compensation (Available on QAV cards at level 6 QAV)

The QAV card is designed to be mounted in a standard Q-line card cage. Connection to the control system is made by a 34-pin rear-edge backplane connector which interfaces the UIOB or DIOB and a 56-pin front-edge connector, which connects to field terminals.

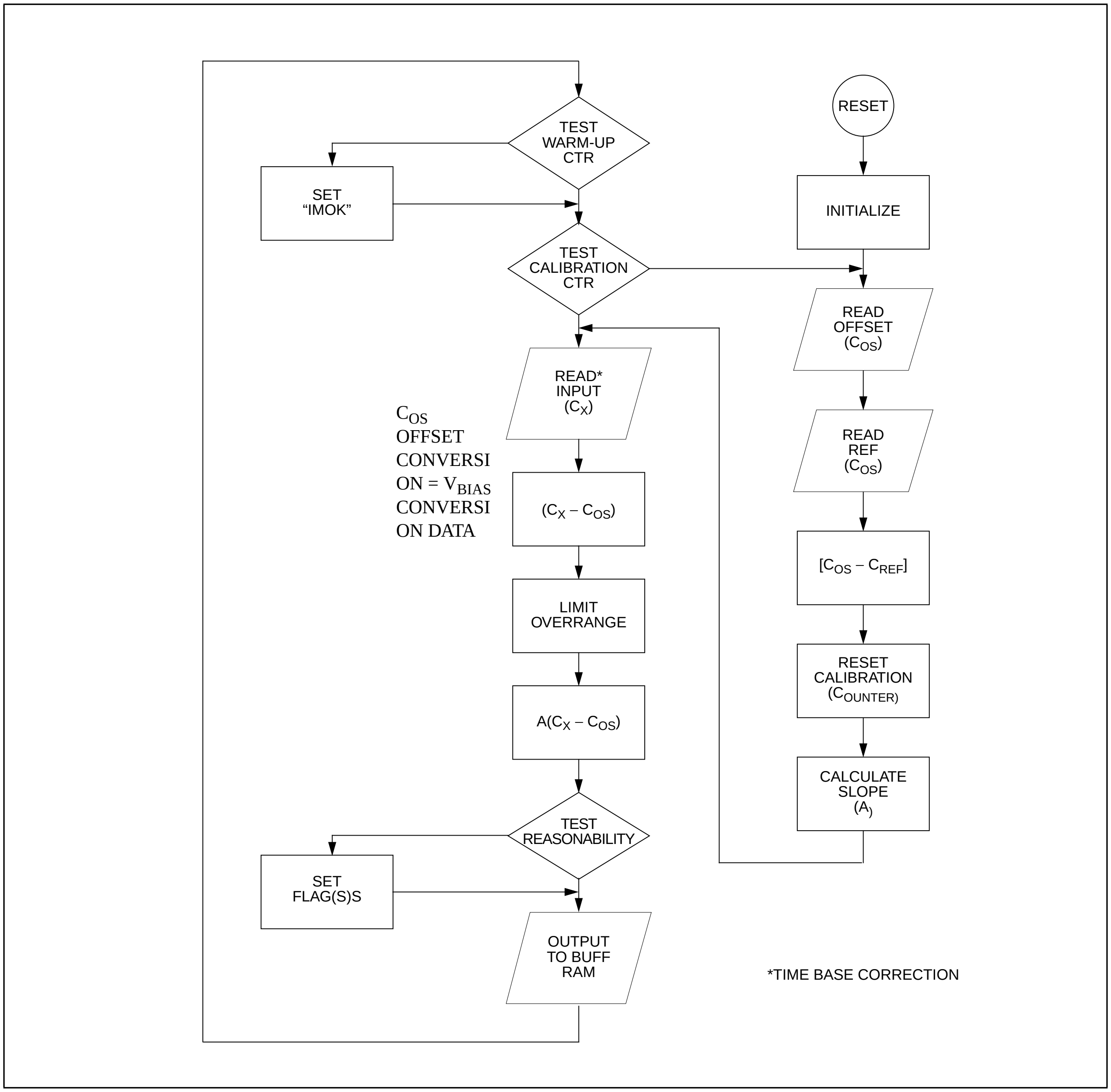

Figure 3-58. QAV Analog-to-Digital Conversion Process Flowchart

3-8.3. Specifications

Inputs

Point Sampling Rate (samples/second):

Note

QAV cards with prefixes of 5 or greater are selected for 50 or 60 Hz operation by jumper. The sampling rate is 4 per second and the sample period is 0.2 seconds for both 50 or 60 Hz operation.

- 4 at a power line frequency of 60 Hz
- 3.4 at a power line frequency of 50 Hz

Note

Once every 32 conversion, auto gain and auto zero calibration are performed; 8 seconds apart in 60 Hz systems, and 9.4 seconds apart in 50 Hz systems.

Resolution: 13-bits (includes polarity bit)

Input Channel Sample Period:

- 0.20 seconds at a power line frequency of 60 Hz
- 0.24 seconds at a power line frequency of 50 Hz

Normal Mode Voltage

- Surge: Meets IEEE/SWC test specifications without damage; however, the accuracy of data is reduced during, and up to 10 secs. after the removal of the surge.
- Continuous: An overrange of +120 VDC or 120 VAC rms at 50 or 60 Hz will not damage the input channels; however, a sustained overrange can affect subsequent data for several minutes following the removal of the overrange voltage.

Normal Mode Rejection

- 60 dB at 50 or 60 Hz using QTB card line frequency tracking or at 50 or 60 Hz +0.5 percent without QTB card
- 30 dB at 50 Hz +5 percent or 60 Hz +5 percent without QTB card line frequency tracking

Note

The input (peak-to-peak) AC voltage must not exceed 100 percent of the upper range value for specified accuracy and normal mode rejection.

Common Mode Voltage

- Surge: Meets IEEE/SWC test specifications without damage; however, the accuracy of data is reduced during, and up to 10 seconds following the removal of the surge.
- Continuous: A maximum of +500 VDC or peak AC can be applied without damage.

Common Mode Rejection

- 120 dB at DC and power line frequency and its harmonics with QTB card line frequency tracking or at 50 or 60 Hz +0.5 percent without QTB card
- 100 dB for nominal line frequency at +5 percent and harmonics without QTB card line frequency tracking

Note

Common mode rejection does not apply if the peak AC value exceeds 200,000 % of upper range value.

Input Impedance

- 10^7 Ω/Volt
- 10^3 Ω in overload

Reference Accuracy (per SAMA Standard PMC 20)

- +0.10 percent of the upper range value (+10 μV); +1/2 of the Least Significant Bit (LSB) at 99.7 percent confidence.
- Reference Conditions: 25°C + 1°C Ambient Temperature; 50 percent +2 percent of relative humidity; 0 V common mode; 0 V normal mode

Drift

- 0.002 percent per month (typical)
- 0.02 percent long term (typical)

Power Requirements

	Minimum	Nominal	Maximum
Primary Voltage:	12.4 VDC	+ 13.0 VDC	13.1 VDC
Optional Backup:	12.4 VDC	--	13.1 VDC
		Nominal	Maximum
Power Supply Current:		1.0 ADC	1.2 ADC
Power Used:		13.0 Watts	15.7 Watts

Input Signal Requirements

- G01 and G07 [1]cards: –5 to +20 mVDC, –20 to +20 mVDC at reduced accuracy[2]
- G02 and G08[1] cards: –12.5 to +50 mVDC, –50 to +50 mVDC at reduced accuracy[2]
- G03 and G09[1] cards: –25 to +100 mVDC, –100 to +100 mVDC at reduced accuracy[2]
- G04 cards: –12.5 to +50 mVDC, –50 to +50 mVDC at reduced accuracy[2]
- G05 cards: –25 to +100 mVDC, –100 to +100 mVDC at reduced accuracy[2]
- G06 cards: –12.5 to +50 mVDC, –50 to +50 mVDC at reduced accuracy[2]

Field signals are input to a standard Q series front-edge connector (see Figure 3-59). The DIOB address and DIOB address protection jumpers are also located in this connector. Each field signal input requires a plus, minus and shield pin.

[1]Level 8 QAV and later artwork support groups 1-3 **without** “On-Card” thermocouple compensation. Groups 7-9 are identical to Level 6 QAV groups 1-3 **with** “On-Card” thermocouple compensation. If “On-Card” thermocouple compensation is required, order groups 7-9 in place of groups 1-3 respectively

[2]Reduced reference accuracy is ±0.20 percent of the upper range value (±10 μV, ±1/2 LSB at 99.7 percent confidence.