3-38. QSE

Sequence of Events Recorder
(Style 7380A36G01 and G02)

3-38.1. Description

Groups 01 and 02 are applicable for use in the CE MARK Certified System

The QSE Card is a DIOB-compatible single-card sequence of events subsystem which provides monitoring of field status points, recording, and time tagging of changes in plant status (see Figure 3-248). Through a rear-edge connector, the QSE interfaces with the Distributed I/O Bus (DIOB), a collection of parallel wires (signal, power, and ground), into which point cards are inserted. The digital inputs are brought onto the card via a front-edge connector.

The QSE interfaces to sixteen field contacts using a common return line. On-card contact-wetting supply, signal conditioning, and optical isolation are provided. Digital filtering is used to reject input signal changes with less than a minimum predetermined time interval (3.5 msec. for Group1 and 3 msec. for Group2). The outputs of the digital filters can be read at any time by the DIOB controller as "current status."

The card contains a "mask register" which can be both read or written by the DIOB controller. The mask register content determines which bits are checked for change of state and cause entries in the Event Buffer. During the power-up the mask register is set to all "ones."

On Group 2 QSE cards, the mask bits have the additional function of holding the corresponding Chattering Flag and Chattering Counter in the reset condition, as long as the mask bit is set to zero. The monitoring for chattering starts at the time the mask bit is set to 1.

Dual Event Buffers are used to permit reading of one Event Buffer, while events are entered into the other Event Buffer.

The Group 2 QSE card has the additional feature of recognizing "chattering" on any of its sixteen inputs. "Chattering" is defined as a condition when the number of input changes exceed four within a specified time interval. This time interval can be set from 20 to 255 msec. in firmware only. After the PROMs are "burned" in the time interval is constant.

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Time Tagging of the status changes is accomplished with the aid of the on-card clock. The clock has a one-minute range, a resolution of 1/8 millisecond for Group1 and 1 msec. for Group2, and an accuracy of ±0.01 percent. The clock can be synchronized by a “Group DIOB Write.”

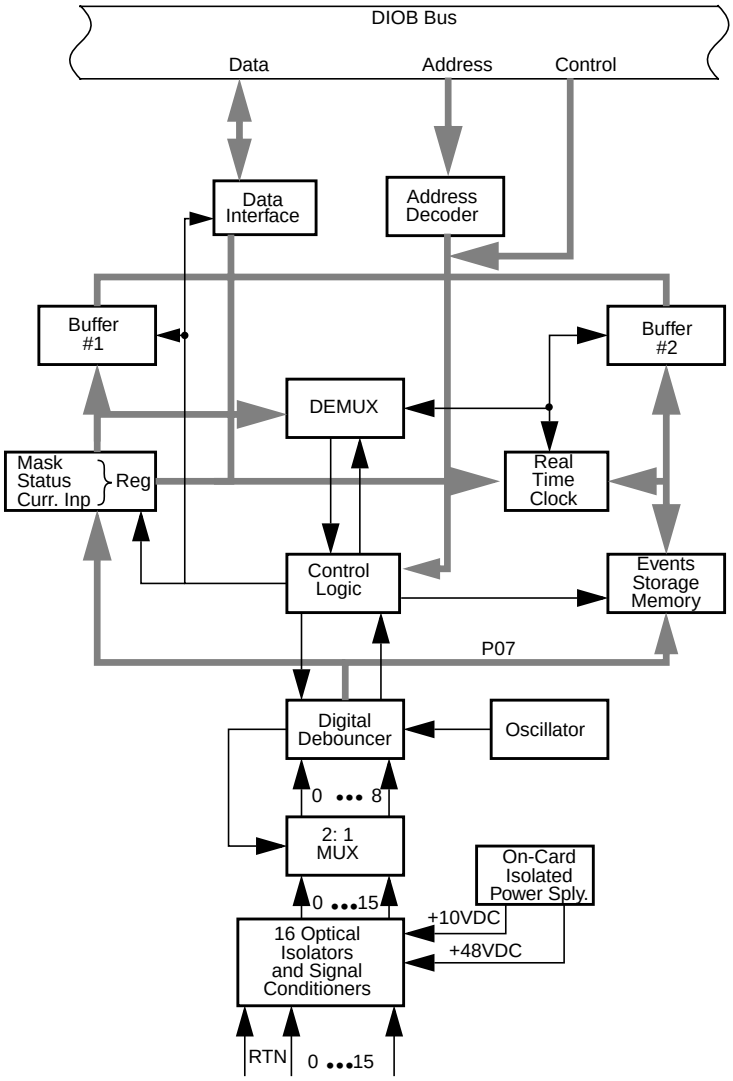


Figure 3-248. QSE Block Diagram

The frequency of the synchronization is controlled by the DIOB controller and it should occur at least once per second.

To facilitate QSE-DIOB controller communication, status and control words are used. The status register can be read by the DIOB controller at any time. It contains the Enable Stack Operation (freeze) bit (Bit 7), QSE Card OK bit (Bit 6), the Event Buffer Overflow bit (Bit 5) and the Number of Events in Buffer field (Bits 0-4). Bit 4 in this field indicates that the Event Buffer is full.

The control word is used to set or reset the Enable Stack Operation (freeze) bit. When the “freeze” bit is set, new events will be entered into the second Event Buffer. The status word is read by the DIOB controller to determine the number of events (N) in the first Event Buffer. The DIOB controller performs 2N reads from the Event Stack location to collect all entries. (Event Buffer and Event Stack are the same.)

After the Event Buffer is read, the control word is used to reset the “freeze” bit. The first Event Buffer is now reset and is available for storing new events.

3-38.2. Features

The QSE card is available in groups (G01 and G02) and has the following features:

- DIOB-compatible, single card sequence of events subsystem.
- Sixteen inputs that also can be read directly.
- On-card 48 V contact-wetting supply.
- IEEE surge withstand capability.
- 500 VDC isolation from DIOB.
- Optical coupling.
- Optical isolation for each input.
- Mask register for flexible sequence of event recording.
- Dual event storage memory.
- LED power supply operating indicators.
- Resolution event recording of 1/8 msec. for Group 1 and 1 msec. for Group2.
- On-card one-minute range synchronizable clock.
- Recognize, mark and inhibit chattering inputs (Group 2 only)

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3-38.3. Specifications

Contact-Wetting Voltage Supplied by QSE

All inputs are optically isolated.

	Minimum	Nominal	Maximum
Open Circuit Voltage (Volts)	42	48	56
Closed Contact Current (mA)	7	14	21

Input Requirements

Field Cable and Contact:

	Minimum	Nominal	Maximum
Leakage Resistance (KΩ)	50	--	--
Group 1 Propagation Delay (msec.)	3.5	4	4.5
Group 2 Propagation Delay (msec.)	3	--	4

Input Signal Rejection

	Group 1 Input Signal Duration	Group 2 Input Signal Duration
Always Rejected	< 3.5 msec.	< 3.0 msec.
Always Passed	> 4.5 msec.	> 4.0 msec.

Power Supply

	Minimum	Nominal	Maximum
Primary Voltage	12.4 V	13.0 V	13.1 V
Optional Backup	12.4 V	--	13.1 V
Current	--	1 A	--

Electrical Environment

IEEE surge withstand capability (Ref. IEEE 472-1974) (Ref. ANSI C37.902-1974). 500 VDC or peak AC between input command and DIOB ground.

Cabling Limitations

Since up to 1.2 mA could flow through any open contact shunt resistance (R_S), from the +48 volt supply (with open contacts, no current can flow from the +10 voltage supply due to reverse biased diodes), 50K ohms is required as a minimum shunt resistance in order to maintain the high level contact-wetting voltage. As an example, if the open contact shunt resistance was 25K ohms, the nominal voltage present across the open contacts would only be 25 volts. However, the minimum open contact shunt resistance that would permit open contacts to be recognized by the QSE card as open contacts is 10K ohms.

In order to ensure that closed contacts will always be recognized as closed by the QSE card, the sum total of the contact series resistance and cable resistance must be less that 60 ohms. See Figure 3-249.

Table 3-132 shows cable length limitations.

Table 3-132. Maximum Cable Lengths (Assume $R_C = 0$) for QSE Card

Cable Wire Gauge	For 16 Commons/Card ($R_R = 0$) Length given is the distance from contacts to termination	For 1 Common/Card Length of return = length of cables to contacts
12 AWG	15,000 feet	1,800 feet
14 AWG	10,000 feet	1,200 feet
16 AWG	6,000 feet	700 feet
18 AWG	4,000 feet	500 feet
20 AWG	2,500 feet	300 feet
22 AWG	1,500 feet	200 feet

Contact Cycle Time

If the maximum QSE on-card generated contact-wetting voltage is to be applied to plant contacts that interface to the QSE card, the elapsed time between the contact's opening and its subsequent closure must be greater than 15 msec.

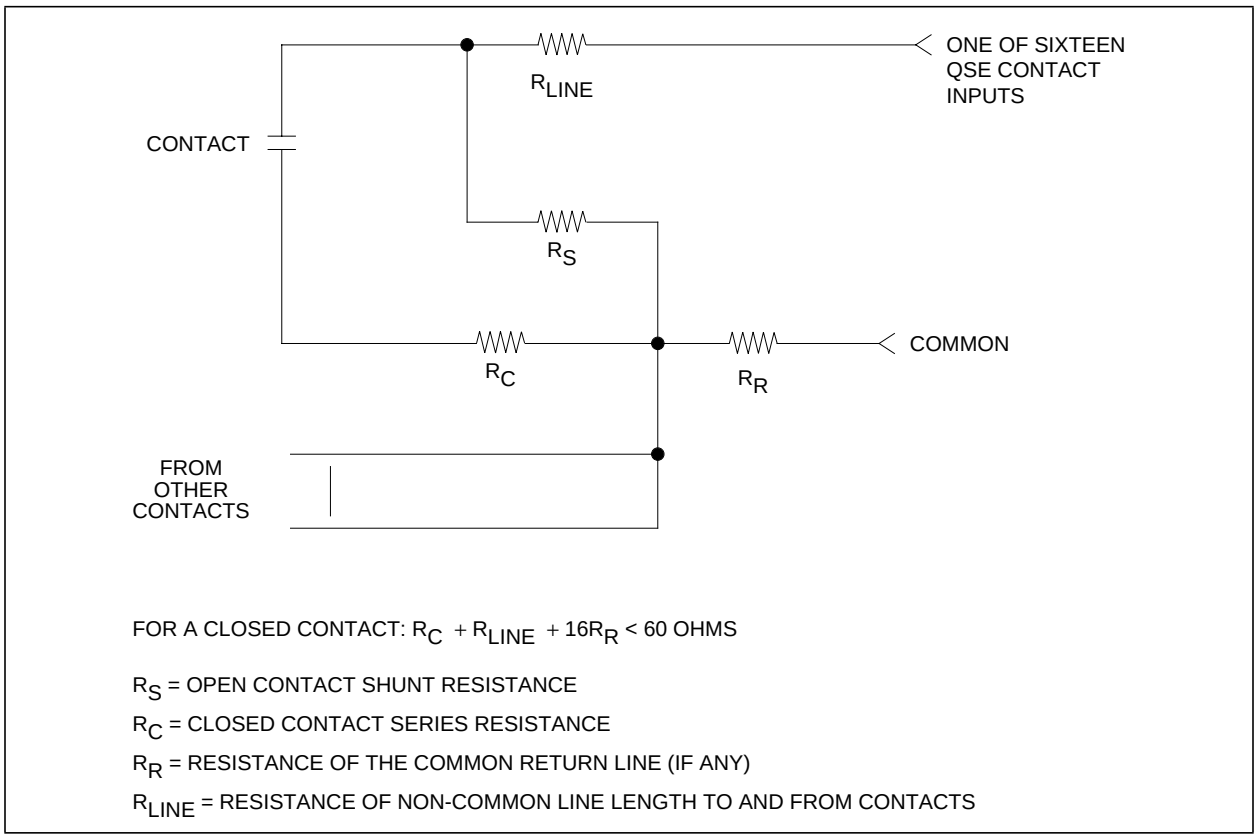


Figure 3-249. Contact Wiring

Event Buffer Capacity

Two Event Buffers are used, each having a capacity of 32 16-bit words. Since each event requires two 16-bit words, the total capacity of the two buffers is 32 events.

Resolution

Event time tagging resolution is 1/8 msec. for Group 1, and 1 msec. for Group 2.

Accuracy

One millisecond, relative to synchronizing.

Rate of Input Change Monitor (Group 2 Only)

In order to recognize “Chattering”, the Group 2 QSE card has an additional counter for each input channel to accumulate the number of changes, and a common counter to measure the time interval (T_i).

Every time the input is scanned, the corresponding mask bit is tested. If the mask bit is 0, then the Chattering Flag and Chattering Counter assigned to the input is reset. Monitoring for chatter starts when the mask bit is set to one.

At the time of an input change, the corresponding input counter is checked for a count of four. If the counter is set to four, the Chattering Flag is set and the change is entered into the Event Register with Bit 7 in the Point ID set to a 1. If the corresponding input counter is less than four, it is incremented and the change is entered to the Event Register. No entry is made to the Event Register if the Chattering Flag (corresponding to the input channel) is set.

At the end of each time interval (T_i), all the input counters are decremented by one count. When an input counter reaches the zero count, the corresponding Chattering Flag is reset allowing future changes to enter the Event Register. The input counters will not “underflow” or exceed the count of four.

Time Interval (T_i)

T_i = 100 msec.

Input rates higher than $1/T_i$ will set the Chattering Flag. Rates lower than $1/T_i$ will reset it.

3-38.4. Signal Interface

DIOB Interface

The QSE card is interfaced to the DIOB via the QSE’s pin J1 connector. See Table 3-133 for a list of the DIOB signals used by the QSE card.

Table 3-133. QSE J1 Connector DIOB Pin Out

Solder Side Signals	Card-Edge Pins		Component Side Signals
PRIMARY	1	2	PRIMARY
BACKUP	3	4	BACKUP
GROUND	5	6	GROUND

Table 3-133. QSE J1 Connector DIOB Pin Out (Cont'd)

Solder Side Signals	Card-Edge Pins		Component Side Signals
UADD 0	7	8	UADD 1
UADD 2	9	10	UADD 3
UADD 4	11	12	UADD 5
UADD 6	13	14	UADD 7
HI-LO/	15	16	R/W_1
UNIT	17	18	DATA-GATE
GROUND	19	20	DEV-BUSY
UDAT 0	21	22	UDAT 1
USAT 2	23	24	UDAT 3
UDAT4	25	26	UDAT 5
USAT6	27	28	UDAT 7
GROUND	29	30	*
*	31	32	*
	33	34	GROUND
*These pins are open. The QSE card does not interface to the following DIOB signal: UFLAG UCAL USYNC UCLOCK			

When the card is addressed by the DIOB controller (read cycles only) and the DIOB control signal "Data Gate" is received, the QSE card will activate the "Device-Busy" DIOB signal line. The appearance of the "Device-Busy" signal indicates to the DIOB controller that the QSE is on the DIOB and is powered up. If the "Device Busy" pulse is missing, the DIOB controller can assume that there is no point card capable of recognizing that particular DIOB address.

Card address assignment is accomplished via the front-edge 56-pin J2 connector. See Table 3-134 for the signal list.

Table 3-134. QSE J2 Connector Pin Out for Address Jumpers

Signal	Card Edge Pin Number
CA7	28B
CA6	27B
CA5	26B
CA4	25B

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