Sequence Diagnostic

SEQDIAG T19

DESCRIPTION

It is a common occurrence in a control situation to find a repetitive sequence of events such as the opening and closing of a number of limit switches. It is also sometimes difficult to detect when one or more of these events has either happened at the wrong time, or not happened at all. The Special Function described here enables the automatic monitoring of any sequence of events such as the one described above, giving a quick and accurate diagnosis should any part of the sequence fail.

FEATURES

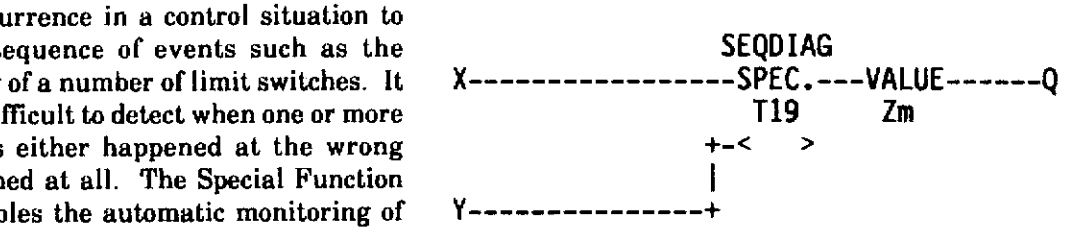
- Comprehensive diagnostic fault codes.
- Sequence self-learning ability.
- Easily reset after fault detection.
- User-definable transition-time bandwidth.
- User-definable sequence length - up to 128 contact changes.

SPECIFICATION

The Sequence Diagnostic Special Function enables automatic learning and monitoring of the operating sequence of a 16-bit input, allowing detection of any error in the sequence; either:

- a bit out of order, or
- an early or a late transition.

Control Language:-



Number of table locations : 11 + 2z where

11	=	number of parameters
z	=	number of transitions to be learnt
X	=	upper branch input to Special Function
	=	16-bit word to be monitored
Y	=	lower branch input to Special Function
	=	mode select, with values as follows:
		Y = 0 : Reset Mode
		Y = 1 : Learn Mode
		Y = 2 : Monitor Mode

APPLICATION NOTES

1. SEQDIAG will only function correctly if it is activated on every scan of the ladder diagram. It must not be enclosed in a temporarily active block unless deliberate suppression is required.

2. You need to carefully identify the sequence you want to monitor since, if an event in the sequence occurs at a fixed point in time rather than relative to the preceding event, nuisance errors may occur.

3. The outputs of the Special Function are such that the selection of error-messages for printer to video is very straight-forward (see programming example).

4. Error messages are of two types, as follows:

i) Programming Errors.

These yield an error code in the first VALUE (Zm) location, describing the nature of the error. Operation of the Special Function ceases until

- the cause of the error is rectified, and
- mode 0 (RESET) has been selected to clear the error-code.

ii) Detached Sequence Errors.

These produce an error-code in the first VALUE location (Zm) describing the nature of the error, such as a contact changing state too early. Further, a bit is set in the rung output word Q, in the same position as the failed bit in the input word.

5. Error-codes.

Error-codes are as follows:

Zm	=	3 :	expected contact changed state early.
Zm	=	5 :	a contact changed state early and out of sequence.
Zm	=	9 :	an unexpected change of state occurred.
Zm	=	17 :	expected contact failed to change state in time.
Zm	=	33 :	Special Function was not reset after a load or monitor operation.
Zm	=	65 :	illegal mode entry (must be 0, 1 or 2)
Zm	=	129 :	illegal sequence length (must be 2 and 128)
Zm	=	257 :	invalid VALUE locations.
Zm	=	513 :	defined time tolerances are invalid (must be 0).
Zm	=	1025 :	successful operation.

You must program the length of the VALUE table and the timing bandwidths (how early or late contacts are allowed to change state) in the appropriate locations in the VALUE table (see table 1).

6. If you do not wish to monitor all the contacts in the input word, then all you need to do is to mask out the appropriate bits in the upper branch input to the Special Function.

This situation could arise if, say, you were monitoring the sequence of operation of fifteen clamps.

7. Note that the sequence-length you supply may be over-ridden by exiting from the LEARN mode before the correct number of changes of state have been recorded.

This will not affect the Special Function, which will monitor the shortened sequence in the normal manner.

Table 1 Program Rung and Value Data

The length of the VALUE data-space is 11+2z where z is the user-defined sequence length. The layout of this memory area is as follows:

Zm	=	diagnostic error messages
Zm+1	=	number of remembered elements in sequence (user defined)
Zm+2	=	over-time limit on the event (user defined)
Zm+3	=	under-time limit on the event (user defined)
Zm+4	=	actual number of learnt events.
Zm+5	=	register of previous inputs.
Zm+6	=	current location in sequence.
Zm+7	=	time since last valid event.
Zm+8	=	mode input on last scan.
Zm+9	=	rung input on last scan.
Zm+10	=	initial contact status.
Zm+11	=	time data.
Zm+12	=	contact pattern.
Zm+13	=	time data
Zm+14	=	contact pattern
.	.	
.	.	
etc.		

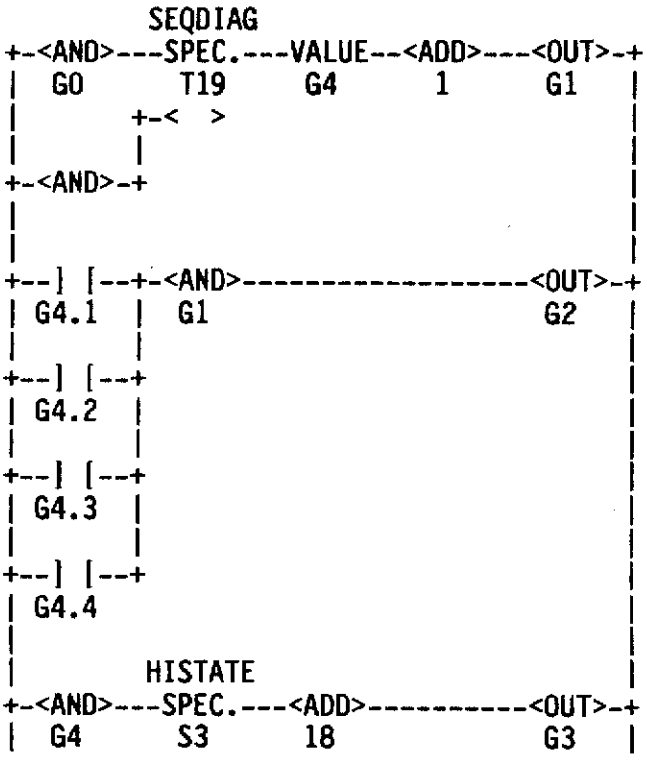
The upper branch input is user-definable. The lower input determines what action the Special Function will take, as follows:

0 : RESET mode : initializes the Special Function to the start of the sequence, ready for learning or monitoring.

1 : LEARN mode : starts the recording of changes of state of input word with appropriate time data.

2 : MONITOR mode : starts monitoring changes of state of input word, cross checking with known sequence. Flags an error if the sequence fails.

Programming example:



The above rungs demonstrate the use of Special Function SEQDIAG.

In this example, the function is being used to monitor the sixteen bits of GO, the learnt data being stored after the function's parameters in the VALUE location. The two rungs following this show how simple selection of a message for a printer of video display may be made. (The first of these shows the decoding of the codes in G4 to enable the correct diagnosis of why the sequence failed to be made, the second shows the use of HISTATE to generate messages for programming errors.)

In this instance, G2 will contain an index to a message list for diagnostic errors, such as a contact occuring late, and G3 will contain a similar index for programming errors. The messages could be stored in P-tables, or as part of the printer messages list.

INDUSTRIAL CONTROLS

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