M102

MICR Decoder PCA

Specification

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Table of Contents

1 Overview and General Description

This document provides the electrical, mechanical, and interface specifications for the model M102 MICR Decoder.

1.1 General Description

The M102 MICR Decoder is a plug-in circuit board which implements algorithms used for the decoding of MICR lines on financial documents. The unit is composed of the following items:

- MICR Decoder PCA

The Decoder includes these features:

- Analog pre-processing circuitry
- Microprocessor controlled operation
- MICR decoding algorithms & firmware
- Asynchronous serial interface
- E13B or CMC7 decoding

The Decoder requires the following items, which are not included, to be fully functional:

- Read-Head: DRS/Ahead Tech.
- Pre-Mag Head: Permanent magnet.
- Power supply
- Interface and control

The M102 can be identified as follows:

- Part Number appears as 71371-1.
- Firmware version and revision are noted by a label affixed to the bottom side of the board.

2   Features and Specifications

2.1 Reading Specifications

Item	Specification
Reading	
Method	Magnetic pickup
Character Sets	E13B
	CMC7
	(user selectable)
Scanning	
Speed	230 mm/sec (9.0 inches/sec)
Regulation	+/- 2.2% (7 mm/sec)
Direction	Right to Left on document
	(Left to Right available on request)
Capacities	
Document Width	200 mm (7.87 inches) maximum
Characters per Line	64 maximum

2.2 Mechanical Specifications

Item	Specification
Dimensions	
Width	100 mm (3.95 inches)
Depth	70 mm (2.77 inches)
Height	15 mm (0.60 inches)
Operating Environment	
Temperature	10 -> 40 C
Humidity	10 -> 90% RH (non-condensing)

2.3 Power Requirements

Item	Specification
Power Supply	
Voltage	+5.00 Volts DC
Regulation	+/- 0.25V
Current	200 mA maximum

2.4 Decoder PCA Wiring Connections

2.4.1 Interface Connector -- Read-Head:

Name	Read-Head Connector
Usage	Connects Analog Read-Head
Type	3-Pin Header
	0.100 inch spacing
Location	J6

Pin	Name	Input/ Output	Usage
1	AGND	--	Analog Ground, Cable Shield
2	AIN+	Input	Analog In -
3	AIN-	Input	Analog In +

2.4.2 Interface Connector -- Host Interface:

Name	Host Interface Connector
Usage	• Implement Serial Host Interface • Provides power to unit • Signals unit to read MICR
Type	6-Pin Header 0.100 inch spacing ELCO part number 00-8263-06-00-000
Location	J1

Pin	Name	Input/ Output	Usage
1	GND	--	Power & Logic Ground
2	VCC	In	+5V Power Source
3	RTS	Out	(Not Used)
4	HSTART	In	Start Read/Decode Signal
5	TXD	Out	Transmit Data
6	RXD	In	Receive Data

Signals	Specification
Logic	Standard HCMOS Levels
V (in) Max.	5.0 V
V (in) Min.	0.0 V
Input Buffer	SN74HC00
Output Driver	SN74HC00

2.4.3 Interface Connector -- Jumper Settings:

Jumpers are installed on Headers J2, J3, and J5. These jumpers indicate various operating modes. Jumper is ON or OFF.

Jumper	Name	Setting	Usage
J2	SW1	ON OFF	Test Mode (Factory Use) Operating Mode
J3	SW2	ON OFF	*HSTART* active high **(Default)** *HSTART* active low
J5	SW3	ON OFF	Reserved

2.4.4 Operator Indicators:

A single LED is included to give an indication of the present state of the machine.

State	Meaning
ON	Decoding or collecting data.
FLASH	Power is ON. Decoder is idle.
OFF	Power is OFF.

2.5 Serial Interface and Control Signals

2.5.1 Serial Communications:

Communications are bi-directional using asynchronous serial protocol with the following parameters:

Item	*Setting*
Data Rate	9600 baud
Data Bits	8
Stop Bits	1
Parity	None
Handshaking	None
Voltage Levels	HCMOS levels
	0V = low, 5V = high

2.5.2 Control Signals -- Host to Decoder:

The *HSTART* signal on the interface is used as a command input. *HSTART* is used to indicate when the decoder should gather read-head data for decoding. *HSTART* should completely bracket the read-head signals.

By default, *HSTART* is active high. However, this can be changed by use of Jumpers on J3. The active high usage is:

> *HSTART*   = 0   Idle
> *HSTART*   = 1   Gather Data & Decode

See also Section 2.8.

2.5.3 Control Signals -- Decoder to Host:

The RTS signal on the interface is used for control outputs from the decoder. This function is not used at this time.

2.6 Data Stream & Command Set

An overview of the supported interface commands is given below. Commands are issued from Host to Decoder. The Decoder only responds to commands and does not initiate any communications.

Type	Sequence	Function
RESET		
	I	Initialize Decoder
CONFIGURATION		
	E	Select E13B decode
	C	Select CMC7 decode
	T n	Set required CMC7 decode confidence
	B	Select Bars pattern debugging decode
STATUS REQUESTS		
	ENQ	Send Decoder status
	R	Send firmware version
	S	Send configuration settings
	A	Send CMC7 debugging status

Detail on each of the supported commands follows in this section. The commands are grouped according to function. A table listing the Hex and Decimal values of each of the codes is provided.

I	Initialize Decoder

This command will initialize the board for first use. This command must be issued before any reading or decoding is possible.

The *HSTART* signal will be sampled only after this command is received and no actions will occur prior to this time. This enables the host to properly initialize itself before the Decoder will perform any functions which might depend on host I/O pins.

Syntax:　　49H

E	Select E13B decode.
C	Select CMC7 decode.

One of these set-up commands should be given prior to reading. The specified font remains in effect until changed.

If a document with the wrong format is read, this will return an error.

Syntax:　　45H　　(for E13B)

　　　　　　43H　　(for CMC7)

T *n*	Set required CMC7 decode confidence

This command will change the required "confidence" for CMC7 decoding. The variable *n* specifies the setting as a percentage of factory recommended value. The formula is:

　　Confidence Percent = 10 * *n*

For example: *n*=8 sets the required confidence at 80% of the recommended value. The recommended value is 40 units. Thus, the required confidence is set to 0.8 * 40 = 32. Percentages are specified by this command to account for any changes in the unit system that may occur in future releases of software.

Syntax:　　54H　*n*

Range:　　$0 <= n <= 10$

Default:　　Confidence Percent = 62.5%

B	Select Bars pattern debugging decode.

This command will selecting a debugging mode of operation. The document to be decode is a series of vertical bars. The decoding algorithm will return a series of numbers corresponding to the time duration between detection of a bar. This string of numbers thereby gives information concerning the mechanical motion of the paper feed mechanism. Consistent motion is within the specification is required, and use of this command is a methods of evaluating compliance.

Data are returned using the same communications protocols used for E13B & CMC7 decoding. The format of the complete string is given in Section 2.7. Each data point is a one byte unsigned integer, with value:

D_i = 8 * number of samples between negative going zero-crossing of MICR signal

for *i-th* and *i+1-th* bar.

Linear interpolation is used to increase the accuracy of the results. The sample rate is 7680 samples/second.

As an example, if the document is printed with 0.02 inch bar spacing, and a returned data byte is 86H = 134D, then speed is calculated as

velocity = (7680 samples/sec * 0.02 inch/bar) / (134/8 samples)

= 9.17 inches/sec

Syntax: 42H

R	Send firmware version.

Upon receiving this command, the unit will respond by sending a sequence of 4 bytes identifying the installed firmware. The format shall be:

Byte	*Use*	*Value*
1	Version Level	00H and above
2	Production Level	• 00H = Production • 01H = Test
3	Carriage Return	0DH
4	Line Feed	0AH

Syntax: 52H

S	Send configuration setting.

Upon receiving this command, the unit will respond by sending 1 byte indicating the state of the configurable jumpers. This information is bit-mapped as follows:

Bit	*Function*	*Value*	
		0	*1*
7 msb	reserved	fixed 0	
6	reserved	fixed 1	
5	reserved	fixed 0	
4	reserved	fixed 0	
3	reserved	fixed 0	
2	SW3	On	Off
1	SW2	On	Off
0	SW1	On	Off

Syntax: 53H

ENQ   Send Decoder status.

Upon receiving this command, the unit will respond by sending 1 byte indicating the current unit status. Information is bit-mapped as follows:

Bit	Function	Value	
		0	*1*
7 msb	reserved	fixed 0	
6	Initialization status	not initialized	initialized
5	MICR font selected	CMC7	E13B
4	LED	Off	On
3	reserved	fixed 0	
2	reserved	fixed 0	
1	Read/Decoding status	Idle	Reading / Decoding
0	Communications	Ready	Busy

Syntax: 05H

A   Send CMC7 debugging status.

Upon receiving this command, the Decoder will return 6 bytes of information concerning the last CMC7 read. This information is formatted as follows:

Byte	Use	Value
1	MICR character count, total	0 to 255
2	Non-read character count	0 to 255
3	Current confidence threshold	0 to 40
4	Minimum confidence (any character)	0 to 98
5	Average confidence (all characters)	0 to 98
6	Average spacing deviation	-128 to 127

Syntax: 41H

2.7 MICR Decoding Communication Protocol

After a completed read of the MICR line, a multi-byte string is sent to the host. This string has the following format:

STX m n R [data] ETX

where:

Item	Use	Value
STX	Start of Transmission	02H
m	LS Byte of *COUNT*	*COUNT* =
n	MS Byte of *COUNT*	Number of bytes in *R, [data]* and *ETX*
R	Return Code	see table
[data]	Decoded MICR information.	string of ASCII characters 20H - 7FH
ETX	End of Transmission	03H

The Return Code specifies any error conditions associated with the read operation.

Return Code	Meaning
30H	No errors.
33H	Error: Read or Decoding error.
34H	Error: Insufficient magnetic ink detected.
36H	Error: Document too long / jam.
37H - 3FH	Error: Reserved for future use.

<u>*Good Read Requirements:*</u>

Return Code 30h will be returned whenever the commanded operation is "successful." For reading MICR lines, this means that the following conditions are all met:

1.   Number of non-deciphered characters ("?") is 2 or less.
2.   Number of deciphered characters is 5 or more.

<u>*MICR Line Decoded Format:*</u>

The *Data* field of the return information contains the complete MICR line. The read out direction is LEFT to RIGHT on the document.

The following tables lists the associations between the MICR symbol on the document and the ASCII character returned to the host.

For E13B MICR Symbology:

Symbol Name	MICR Symbol	Character Returned	Hex Value
space	" "	" "	20H
0123456789	0123456789	0123456789	30H to 39H
Dash	⑊	A	41H
Amount	⑈	B	42H
Transit	⑆	C	43H
On-Us	⑇	D	44H
Unknown		?	3FH

The question mark character "?" is returned if a character can not be deciphered with an adequate confidence level.

Example MICR Line Decoding:

Consider this example E13B document:

⑆123456789⑆ 0616⑈987654⑇

The decoded Data field will be returned as:

```
C123456789C 0616A987654D
```

With a non-error Return Code, the complete string (in Hex) returned to the Host will be:

```
x02 x1A x00 x30 x43 x31 x32 x33 x34 x35 x36 x37 x38 x39 x43
x20 x30 x36 x31 x36 x41 x39 x38 x37 x36 x35 x34 x44 x02
```

where, for example, x02 represents 02H and so on.

2.8 MICR Decoding Control Procedure

2.8.1 Reading & Decoding Procedure:

The Host follows this procedure to cause the Decoder to read and decode 1 MICR Line.

1. Host initializes the Decoder at power-on. This is required only once.

2. Host sends MICR font selection (E13B or CMC7).

3. Host mechanism moves document and read-head into position. Mechanism begins moving document at scan rate.

4. When document is under read-head at scan rate, Host asserts the *HSTART* interface signal line to logic HIGH (CMOS Level 5.0 V).

5. Decoder begins sampling read-head signals approximately 1ms after *HSTART* is asserted.

6. When document has left the read-head, Host de-asserts the *HSTART* interface signal.

7. Decoder immediately stops sampling read-head.

8. Decoder decodes MICR line and transmits results back to Host.

2.8.2 Reading & Decoding Timing Requirements:

The signal *HSTART* may be asserted for a maximum of 0.84 seconds. This allows the read-head to cover about 200 mm (7.9 inches). If *HSTART* is asserted for longer, then all data gathered after 0.84 seconds will be lost.

The decoding process is started after all data is gathered. This process takes approximately 0.5 seconds for typical documents. Maximum decode time, assuming full MICR line and unlikely characters, would take approximately 1.5 seconds.

3 Required Auxiliary Components

3.1 MICR Read-Head

This item is not supplied with the decoder board. The Decoder is set to use the DRS/Ahead Tech. read-head.

       Manufacturer: DRS/Ahead Tech.
       Part Number: varies depending on mounting

3.2 MICR Pre-Mag Head

This item is not supplied with the decoder board. The Decoder assumes use of a permanent magnet assembled into a molded plastic holder. Proper orientation of the magnet relative to the Read-head is required as both items have an associated polarity.

3 Document Revision Information

Revision	Date	Changes
1.0	05-12-99	Initial release.
1.1	12-22-99	Changed document format to Word6 & PDF. Added: • 'A' command
1.2	12-28-99	Added: • 'A' command detail • 'T' command detail
1.3	01-13-00	Added: • 'B' command detail
1.4	03-15-00	Changed: • Model name to "**M102"**