3M Identity Management

3M™ CR100 Document Reader Protocols Programming Manual

Manual No: DT-01937

Version A

Date: May 2015

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1 INTRODUCTION

1.1 Warnings, Cautions and Notes

This manual contains important information regarding the installation and operation of the 3M™ CR100 Document Reader and 3M™ CR100M OCR/MSR Document Reader. For safe and reliable operation of the readers all users must ensure that they are familiar with and fully understand all instructions contained herein.

Danger indicates a hazardous situation which, if not avoided, ***will*** result in death or serious injury.

Warning indicates a hazardous situation which, if not avoided, ***could*** result in death or serious injury.

Caution indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

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Information indicates important information that helps get the optimum performance from your scanner and will save you time during evaluation and deployment.

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1.4 Revision History

A	May 2015	Original

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2 INTRODUCTION

The 3M™ CR100x OCR/MSR Document Reader is a range of versatile codeline readers (also known as Swipe Readers) which speedily captures data from passports, visas, tickets and other travel documents. The range currently includes the 3M™ CR100 Document Reader and the 3M™ CR100M OCR/MSR Document Reader.

The 3M™ CR100x OCR/MSR Document Reader is supported by a Software Development Kit which provides simple integration of the reader and its functions into your application and is backed up by 3M's dedicated technical support team. Virtually maintenance-free the 3M™ CR100x OCR/MSR Document Reader fits into any environment whether commercial or government. 3M codeline readers have an exceptional track record and are in use by governments and major corporations throughout the world.

This manual documents the various protocols in use in the 3M™ CR100x OCR/MSR Document Reader including the standard RTE Protocol. Other protocols are US CBP's TECS, SITA's CUTE® and Rockwell Collin's ARINC MUSE®. The manual provides a full description of the protocol and a guide to its use. Other useful information is also included.

The following documents are also applicable:

DT-01936	3M™ CR100 Document Reader and 3M™ CR100M OCR/MSR Document Reader Getting Started Guide

To change between protocols requires a configuration change. See section 8.2 of the 3M™ CR100 Document Reader and 3M™ CR100M OCR/MSR Document Reader Getting Started Guide. Remember to run the Configuration wizard after changing protocols, see section 8.1 of the Getting Started Guide.

To help evaluate which protocol is required for individual applications the Swipe Reader Messages program is worth studying (see section 5.1 of the 3M™ CR100 Document Reader and 3M™ CR100M OCR/MSR Document Reader Getting Started Guide).

Note: In this manual, the 3M™ CR100 OCR Document Reader and 3M™ CR100M OCR/MSR Document Reader are collectively referred to as the 3M™ CR100x OCR/MSR Document Reader. Images used in this manual may show the 3M™ CR100 OCR Document Reader or the 3M™ CR100M OCR/MSR Document Reader, but in most circumstances, apply to both devices.

3 RTE PROTOCOL OPERATING MODES

The 3M™ CR100x OCR/MSR Document Reader with the RTE Protocol installed is able to operate in three modes, namely native, polled and interrupt.

The message structures are the same for all modes, the main difference is in when the data is sent from the reader:

Native	Simplest mode, all data is sent as it is read. The reader accepts no commands. The reader automatically re-enables devices and controls the LEDs and Buzzer.
Polled	Full control of the reader is provided through commands. No data is sent to the host after a read and the host has to poll the reader to discover that data is available.
Interrupt	Full control of the reader is provided through commands. When a document is read some data is sent unsolicited to the host informing the host of the read.

In native mode the reader controls the LEDs and buzzer by checking the data for unrecognized characters. If all the read data is correct then the Green LED for that device is flashed for 2 seconds, otherwise if there are unrecognized characters then the buzzer is sounded and the Red LED for that device is flashed for 2 seconds. The reader does not accept any commands. Native mode is the simplest mode to implement but the host must be able to accept data at any time. It is not necessarily the best mode to use if you don't want all the data, cannot accept data at any time, wish to prevent the operator using the device by disabling it or need to control the LEDs or buzzer. In native mode data is sent unsolicited with the type byte set to "U", all the data read is returned to the host.

In polled mode no information is sent to the host except in response to an explicit request. This mode provides a high degree of control over the reader and ensures data is only sent to the host when the host is ready to receive it. However it does require the host to continuously request the status of the reader which increases the total communications overhead on the reader and the host processor.

In interrupt mode information is transmitted to the host as soon as it is available from a device, without waiting for an Inquire command. Where the Inquire command for the device includes a [modifier] byte the unsolicited data transmitted corresponds to a [modifier] byte of "0". This is the recommended mode of operation if you require control of the reader but it does mean that the host must be able accept data at any time. The power-on reset status message is also transmitted unsolicited when in interrupt mode.

All unsolicited data is transmitted with a type byte in the header of "U".

Whilst there is no difference in the message structures of the modes the mode selected is fundamental to the way the host application is written. Careful consideration should be given prior to specifying an application as to which mode is most suitable for your needs.

If the reader is used in interrupt mode and commands such as the LED command, are transmitted to the unit, care must be taken when looking for the reader's command response that unsolicited data messages are not confused with the expected response. In interrupt mode you can have separate 'conversations' with each device, but note that the simple ACK or NAK responses cannot be matched to the command sent.

The advantage of working in interrupt mode is that less communications traffic is required than in polled mode, because in polled mode it is required to continuously "inquire" of the reader. This may become important if several readers are being serviced off one host. Polled mode tends only to be used where the host can only accept data at certain times.

In interrupt mode the host application should be able to buffer up multiple messages as it is possible to have unsolicited data from all devices at once, plus a power-on reset message. The number of buffers required can be reduced by only enabling one device at a time, but still allow 1 extra for the reset message.

Native mode is the simplest to implement, as it requires only one-way communication and all data is sent to the host in one message.

The reader acts like a number of multiple devices with each device carrying out separate streams of conversations to the host.

In addition the programmer must decide whether to implement message checksums (known as BCC), the BCC should be used to improve data integrity but is an extra programming task that some programmers prefer to avoid.

To change between modes requires a configuration change. See section 8.2 of the 3M™ CR100 Document Reader and 3M™ CR100M OCR/MSR Document Reader Getting Started Guide. Also refer to **Appendix B – Test Card Configuration of RTE Protocol**.

To help evaluate which mode is required for individual applications the Swipe Reader Messages program is worth studying (see section 5.1 of the 3M™ CR100 Document Reader and 3M™ CR100M OCR/MSR Document Reader Getting Started Guide). This program is also the best way of seeing the sequence of control messages to operate in either mode.

In polled and interrupt modes, after initialisation (which requires no special commands if the operating mode and BCC state are already known) the reader can be operated with a basic read, enable, read .... sequence. Remember that each device requires a separate "conversion", with each conversation independent of the others.

A typical example of a conversation cycle for a device when the reader is operating in interrupt mode is as follows:

Message:	CR100	Host
Enable Insertion	←	
ACK		→
Unsolicited data (on read)		→
Inquire all data	←	
Data		→
Buzzer	←	
ACK		→
LED	←	
ACK		→
Enable Insertion	←	
ACK		→

A typical example of the same sequence for polled mode is:

Message:	CR100	Host
Enable Insertion	←	
ACK		→
(Inquire device	←	
(General status		→
(Repeat until status indicates data read)		
Inquire all data	←	
Data		→
Buzzer	←	
ACK		→
LED	←	
ACK		→
Enable Insertion	←	
ACK		→

When writing a program to implement either of these protocols you should allow for alternative messages to be returned from the 3M™ CR100x OCR/MSR Document Reader when there is an error e.g. NAK. The Smart Card reader requires additional commands if it is to be written to.

The simpler native mode is as follows:

Message:	CR100	Host
Unsolicited optical data (on read)	→	
Unsolicited MSR data (on read)	→	
Unsolicited MSR data (on read)	→	
Unsolicited optical data (on read)	→	
Unsolicited optical data (on read)	→	
Unsolicited MSR data (on read)	→	

Data from devices can be in any order.

The common use system CREWS, provided by RESA, uses RTE protocol in interrupt mode with BCC enabled.

4 RTE PROTOCOL PROGRAMMING INFORMATION

The 3M™ CR100x OCR/MSR Document Reader are multi-function data capture devices and this is reflected in the data protocol used by the unit.

Information to and from the unit is sent in the form of blocks.

In the following descriptions hexadecimal values are represented by a four character string of the form \x?? where ?? is the two character hexadecimal value in question.

e.g. `ASCII character A =\x41.`

ASCII control characters are shown as the ASCII mnemonic enclosed within < >.

e.g. `<ACK> =\x06`

ASCII characters and strings are shown enclosed within double quotation marks.

e.g. `"ABC" =\x41 \x42 \x43.`

Square brackets are used to separate various elements of transmitted data. The square brackets and the text within are merely identifiers and do not constitute transmitted data in their own right.

The characters "< > [ ] and the space character are always shown as their hexadecimal equivalents if actually part of transmitted data.

The Smart Card information is included for completeness; however this option is no longer supplied.

4.1 Basic Data Format

Data to and from the reader is transmitted in the form of blocks with the following generalised format.

```
<SOH>[header information]<STX>[text information]<ETX>[BCC]
```

Each element is defined in more detail below.

4.1.1 Header Information

The header contains information regarding the block and allows the data to be associated with specific devices within the 3M™ CR100x OCR/MSR Document Reader. The general format of the header is as follows:

```
[length word][device byte][type byte]
```

`[length word]` : a 14 significant bit word in [low byte][high byte] format with a value equal to the number of bytes (including checksum) following the [length word]. Only seven bits of each byte are significant and as such the length is given by:

`[high byte]*128 + [low byte]`

`device byte]` : a single byte identifying with whom the block is associated. Possible values for this byte are as follows:

- `"0"` : The device itself.
- `"A"` : ATB reader.
- `"C"` : Credit card reader.
- `"O"` : Optical reader (OCRB, E13B, TATs, ATBs & barcode).
- `"!"` : Reserved - do not use for commands, ignore otherwise.

`[type byte]` : a single byte providing additional information as to the contents of the [text information].

Permissible values for this byte are:

- `"C"` : command
- `"D"` : data
- `"U"` : unsolicited data
- `"E"` : error response

4.1.2 Text Information

The [text information] format is dependent upon the device being addressed and whether the header specifies a command or data. In general if a command is specified the [text information] contains the actual command specifier. If data, unsolicited or otherwise, is specified the [text information] contains the actual data received by a device.

4.1.3 BCC

The BCC character is a longitudinal parity check digit for the entire block but excluding the starting <SOH>.

To compute the checksum a bit-wise exclusive - OR of all the characters in the block should be performed. (N.B. excludes the <SOH>)

The resulting character will be the required checksum.

When checking the received block an exclusive - OR of all the characters in the block, excluding the <SOH> but including the [checksum] should produce a result of 0.

The BCC character is optional and may be disabled during configuration.

4.2 General Commands

No commands are processed in native mode.

The 3M™ CR100x OCR/MSR Document Reader, in interrupt or polled mode, supports a number of commands which allow various aspects of the reader to be controlled. The [type byte] in the header for these commands is always "C". These commands are described in more detail below.

4.2.1 D - Disable Insertion Command

Format:
`<SOH>[length][device]"C"<STX>"D"<ETX>[BCC]`

The Disable Insertion Command prevents further reads for the associated device. After receipt of the command a new document or card inserted in the associated device of the reader will not cause it to be read or the data available flag to be activated, i.e. the document or card is ignored. The command also resets any control and error flags. However the data available flag in the general status message is not affected by the Disable Insertion Command, thus you do not lose acquired data.

The device is automatically disabled for Insertion when a document or card is inserted into an enabled device.

The Command, although acknowledged, has no effect with device "0".

Responses:
Command actioned : `<ACK>`
Error condition : `<NAK>`

4.2.2 E - Enable Insertion Command

Format:
<SOH>[length][device]"C"<STX>"E"<ETX>[BCC]

The Enable Insertion Command allows the associated device to read the next document inserted. Any data previously captured by the device is lost, control and error flags are reset and the device is prepared to expect a new document. Enabling device "0" is acknowledged but performs no actual function.

In all devices the data is read when a document is swiped and the device has been enabled for insertion. The data is then held in the reader's internal buffers.

Responses:
Command actioned : <ACK>
Error condition : <NAK>

4.2.3 I – Inquire Command

Format:
<SOH>[length][device]"C"<STX>"I"[modifier]<ETX>[BCC]

The inquire command requests information from the specified device. If available, data received from the device is transmitted back to the host.

The [modifier] byte is device specific and is only present for device "C". In these two cases the modifier provides information regarding the tracks associated with the data. The values for the [modifier] byte are as follows:

device "C" - modifier = "0" : track 2
"1" : track 1
"2" : track 2
"3" : track 3
"A" : all tracks 1, 2 & 3

The [modifier] is not present for any other devices.

Responses:
Data available:
<SOH>[length][device]"D"<STX>[modifier][data string]<ETX>[BCC]

No data:
<SOH>[length][device]"D"<STX><ETX>[BCC]

Device 0:
<SOH>[length]"0D"<STX>[status]<ETX>[BCC]

or
<SOH>[length]"0D"<STX>[POR_status]<ETX>[BCC]

Error:
<NAK>

4.2.4 L-LED Command

Format:
<SOH>[length][device]"C"<STX>"L"[status][modifier]<ETX>[BCC].

The reader incorporates two tri-coloured LEDs, one associated with the magnetic reader and the other with the optical and internal barcode reader. This command allows the LED to be controlled by the host. Only devices "C" and "O" are valid. Devices "C" and "O" share the same physical LED.

The [status] is a single byte with the following possible values:

```
"A"     =   amber
"G"     =   green
"R"     =   red
"0"     =   off   ("\x30")
```

The [modifier] is a single byte with the following possible values:

```
"B"     =   blink on
"O"     =   on - no blink
```

The [modifier] byte is not required for [status] = "0".

Although the LEDs are under host control the reader automatically switches off an LED after a document is recognised as having passed through the associated slot.

Responses:

Command actioned	<ACK>
Error condition	<NAK>

4.2.5 B-Buzzer Command

Not implemented in the 3M™ CR100x OCR/MSR Document Reader.

4.2.6 R-Reset Command

Format:

```
<SOH>[length][device]"C"<STX>"R"<ETX>[BCC]
```

The reset command clears any communication buffers associated with the device.

Data which has begun transmission to the host is unaffected. Partially transmitted messages to a device are completed. The selected device is then enabled. See also section 4.5.

If device "0" is reset then a power-on reset is performed.

Responses:

Command actioned	<ACK>
	If device "0" is reset the reader will try to transmit the <ACK> prior to the power-on reset. However, should transmission be prevented because the hardware handshake lines are not asserted, the <ACK> may not be received by the host.
Error Condition	<NAK>

4.3 Data Responses

All data responses from the 3M™ CR100x OCR/MSR Document Reader have the [type byte] in the header set to either "D" or "U".

Most data responses refer to data read from a device. However, for device "0" the data refers to the reader's status. Data is transmitted according to the table in **Appendix A – Character Sets**

The [type byte] of "U" is for unsolicited data in interrupt mode or all data in native mode and is discussed in Section 3 above.

4.3.1 Data from Device "A"

Not implemented in the 3M™ CR100x OCR/MSR Document Reader.

4.3.2 Data from Device "C"

Format:
Solicited:
<SOH>[length]"CD"<STX>[modifier][requested data]<ETX>[BCC]

Unsolicited (interrupt mode):
<SOH>[length]"CU"<STX>"0"[data]<ETX>[BCC]

Unsolicited (native mode):
<SOH>[length]"CU"<STX>"A"[data]<ETX>[BCC]

The data is normally sent in response to an Inquire command and as such may include multiple track information. The [modifier] byte specifies which tracks have been transmitted namely:

[modifier]	=	"0"	:	track 2
		"1"	:	track 1
		"2"	:	track 2
		"3"	:	track 3
		"A"	:	all tracks 1 - 3

If only one track is requested the [request data] format is:

```
[track information]";"
```

If more than one track is requested they are separated by ";" character.

e.g. 3 tracks requested:

```
[track 1]";"[track 2]";"[track 3]";"
```

If a checksum error in the magnetic stripe data is found a "*" character is transmitted.

e.g. checksum error on track 3:

```
[track 1]";"[track 2]";*;"
```

4.3.3 Data from Device "O"

Format:
Solicited:
<SOH>[length]"OD"<STX>[flag][optical data]<ETX>[BCC]

Unsolicited (Interrupt and native):
<SOH>[length]"OU"<STX>[flag][optical data]<ETX>[BCC]

The optical reader is capable of reading three lines of data with the first line being the highest on the document. The [optical data] field consists of 3 lines separated by the <CR> character. The general format for [optical data] is:

[line 1]<CR>[line 2]<CR>[line 3]<CR>

If a line is not present the associated <CR> is always transmitted. If two lines are found then line 1 is assumed to be missing and if one line is found, then lines 1 & 2 are assumed missing. Another way of putting this is that the bottom line of the document is always line 3.

e.g. only one line found transmitted as:

<CR><CR>[line 3]<CR>

If 3 lines of OCRB data are present the data is assumed to conform to the format of the US Resident Alien Card (I-55) and ICAO Machine Readable Travel Card both of which are limited to 30 characters per line. Over length lines are truncated from the right. Each line is padded with the underscore character "_" to the required 30 characters.

If 2 lines of OCRB data are present the data is assumed to conform to the ICAO 9303 standard for machine readable passports and visas and is limited to 44 characters per line. Each line is padded with the underscore character "_" to the required 44 characters. Over length lines are truncated from the right.

If one line of E13B data is found, this is assumed to conform to ANSI X9.13.

INFORMATION **Note that E13B, IATA barcodes and ticket reading require special hardware and firmware which must be enabled, see** Error! Reference source not found.

If a barcode is found on an airline ticket (TAT) then the barcode data is returned in [line 1], and a single line of optical data in [line 3]. In this case the [flag] byte is "5".

INFORMATION **Note that a barcoded document will always return a single OCR data line in [line 3] regardless of type of document.**

e.g. [line 1]<CR><CR>[line 3]<CR>

The only valid barcode is the 15 character IATA barcode to Recommended Practice 1720a Attachment F.

If an airline font (OCRA, OCRB, IBM 1403M or IBM 407E-1) on an ATB or TAT is found a single line of data will be returned in [line 3] and the [flag] byte will be set to "5" or "6" depending on document type. If no barcode is correctly decoded [line 1] will be empty otherwise it will contain the 15 digit code. Additional characters are defined in **Appendix A – Character Sets**

The optical data from TATs and ATBs appears in the third line of the data, as a single line document. If a TAT has a SCN extracted there is no attempt to extract the computer generated FSN. For instance a TAT or ATB returning just a single SCN or FSN:

<CR><CR>117644608013885<CR>

An ATB returning both the SCN and FSN (SCN is first):

<CR><CR>10001002520422<00043526172833<CR>

INFORMATION **Note that the above example shows an ATB with the filler separating the SCN from the FSN which is only present in "Extract SCN/FSN number only" mode.**

The [flag] byte is always present but is specifically used to provide information regarding the validity of E13B data. The values for the [flag] byte are as follows:

[flag]	=	"0"	OCRB data without any E13B characters.
	=	"1"	E13B data but no ANSI X9.13 routing field identified.
	=	"2"	E13B and ANSI X9.13 routing field identified but with incorrect check digit.
	=	"3"	E13B data with ANSI X9.13 routing field identified and with a valid checksum.
	=	"5"	TAT or barcode or OCR lozenge or OCR target detected.
	=	"6"	ATB detected.

With OCRB, E13B, 1403M and 407E-1 fonts any unrecognised characters are transmitted as the underscore character "_". An invalid barcode returns no data at all.

4.3.3.1 Sample Messages

Passport, 2 Line by 44 characters

<01>`<00>OU<02>0<0D>
P<NTZROCHFORD<THOMPSON<<EQUIPMENT<LIMITED<<<<0D>
1234567897NTZ6401263M0801012<<<<<<<<<<<<<<06<0D>
<03>

ID Card, 3 Line by 30 characters

<01>b<00>OU<02>0IDGBR000003<<<3<<<<<<<<<<<<<<<0D>
6106203M9711127GBR<<<<<<<<<<<4<0D>
PETEESCNRC<EFJCTNHALIEUMADDCI<<0D>
<03>

ID Card, 2 Line by 36 characters

<01>`<00>OU<02>0<0D>
V<USAMANDELSON<<STEVEN<HARRY<<<<<<<<_____<0D>
000002<<<2USA5607032M9904031<<<<<<<<_____<0D>
<03>

4.3.4 Data from Device "0"

Format:
Solicited (first inquire after power-on reset in polled mode)

```
<SOH>[length]"0D"<STX>[POR_status]<ETX>[BCC]:
```

Unsolicited (Power on Reset in interrupt mode only):

```
<SOH>[length]"0U"<STX>[POR_status]<ETX>[BCC]
```

Solicited (all other situations):

```
<SOH>[length]"0D"<STX>[status]<ETX>[BCC]
```

Data from device "0" provides information regarding the status of the 3M™ CR100x OCR/MSR Document Reader. The first status message provided by the device "0" after a power-on reset provides configuration information. Subsequent status messages provide information regarding the current status of the unit. These are described more fully below.

Power-on Reset Status

The power-on status has the format:

```
"CR100 [M or \x20] \x20\x20" [cfg byte] "\x20 vxx.xx \x20" [device
1]...[device n]
```

The [cfg byte] provides information regarding the current configuration of the reader. This byte is bit significant with the following meanings:

bit 0	-	0	=	polled mode	1	= interrupt mode
bit 1	-	0	=	BCC off	1	= BCC on
bit 2	-	0	=	bit 0 defines the mode	1	= native mode
bit 3	-	unused				
bit 4	-	unused				
bit 5	-	unused				
bit 6	-	always 1				
bit 7	-	unused				

vxx.xx is the current firmware release.

The bytes [device 1][device 2]...[device n] are a list of the available devices. e.g. for a 3M™ CR100M OCR/MSR Document Reader configured with an OCR reader and credit card reader and a firmware release of 22.07, the power-on status would be:

```
"CR100M \x20\x20 [cfg byte] \x20 v22.07 \x20 0ACO"
```

Note that device "0" is listed. The order of devices is not significant. For a 3M™ CR100 Document Reader the power-on status would be:

```
"CR100 \x20\x20\x20 [cfg byte] \x20 v22.07 \x20 0O"
```

General Status

The format of the general [status] message is a list of devices followed by an associated individual device status byte, namely

```
[device 1][status device 1]...[device n][status device n]
```

The [status device n] byte is bit significant with the following meanings:

bit 0	-	0	=	disabled	1	= enabled
bit 1	-	0	=	transmit to device not allowed	1	= Ok-to-transmit to device
bit 2	-	0	=	no data received from device	1	= data received from device and ready
bit 3	-	unused				
bit 4	-	unused				
bit 5	-	unused				
bit 6	-	always 1				
bit 7	-	unused				

bit 1 *Ok-to-transmit flag:* may be false (0) because the device does not support transmission to it, the device is busy or writing to the device has not been enabled.

bit 2 *Data available flag:* is reset to 0 when the device is reset or is enabled for insertion or when the reader is reset. In the case of the Smart Card device the removal of the card also resets the flag. Bit 2 is set active (1) when a document is swiped through an enabled for insertion device or a Smart Card is inserted into the slot and the device has been enabled for insertion.

INFORMATION

In polled mode any device 0 inquire should be checked for a POR_status and appropriate action taken, prior to decoding as a general status message.

In interrupt mode a POR_status message can appear at any time (in response to a power fail for instance) and the message handling routine should ensure it can cope with this message unsolicited and take the appropriate action.

4.4 Error Messages

Messages sent by the reader with a header [type byte] of "E" are error responses to commands sent by the host. Their general form is:

```
<SOH>[length][device]"E"<STX>[error_msg]<ETX>[BCC]
```

[error_msg] is a list of freeform error codes, each code consisting of one alphabetic character and two numerics, all in ASCII e.g. "S01". Each error code is always 3 bytes long and as many codes as necessary can be contained in [error_msg].

Currently the following codes are defined:

`"E10"` Data available flag is not set, and should be for requested operation.

`"E11"` Ok-to-transmit flag is not set and should be for requested operation.

4.5 Error Recovery and Power-On Reset

If data is transmitted with an even parity byte and the longitudinal parity check digit the chances of any communications errors passing undetected are extremely small. The message blocks also allow for secure communications. However, in the event of communications becoming so corrupted that the application is unable to proceed, the host is still able to force the reader to perform a power-on reset.

.

5 US CBP TECS PROTOCOL

The US Customs and Border Protection Treasury Enforcement Computer System Interface uses the serial port running at 9600 baud, 8 data bits and no parity.

The only command the reader will accept is the NAK character (ASCII hex 0x15) which will force the reader to reset.

The OCR data stream is as follows:
<start> line1 <CR> line2 <CR> line3 <CR> <id> <end>

where:

<start>	is ASCII hex 0x1d (GS)
<CR>	is ASCII hex 0x0d (carriage return)
<id>	if good read ASCII hex 0x06 (ACK) else 0x15 (NAK)
<end>	is ASCII hex 0x04 (EOT)

The number of <CR> characters match the number of code-lines decoded from the document, thus a 2-line passport will return two data lines and 2 <CR> characters.

An unrecognised character is replaced by an underscore character (_) ASCII hex 5F. If a document is blank or cannot be decoded then one line of data shall be sent containing 30 underscores with 1 carriage return.

MSR data may be sent using <start> as ASCII hex 0x1e (RS).

5.1.1.1 Sample Messages

Passport, 2 Line by 44 characters

```
<1D>P<NTZEDWARDS<<MMM<<<<<<<<<<<<<<<<<<<<<<<<<<<<<0D>
1234567897NTZ6401263M0801012<<<<<<<<<<<<<<06<0D>
<06><04>
```

ID Card, 3 Line by 30 characters

```
<1D>IDGBR000003<<<3<<<<<<<<<<<<<<<0D>
6106203M9711127GBR<<<<<<<<<<<4<0D>
PETEESCNRC<EFJCTNHALIEUMADDCI<<0D>
<06><04>
```

ID Card, 2 Line by 36 characters

```
<1D>V<USAMANDELSON<<STEVEN<HARRY<<<<<<<<________<0D>
000002<<<2USA5607032M9904031<<<<<<<<________<0D>
<06><04>
```

6 SITA CUTE® PROTOCOL

The 3M™ CR100x OCR/MSR Document Reader conforms to the "Miscellaneous Readers Interface for SITA CUTE System" revision 4.0. A copy of this specification is available only from SITA.

The readers present a wedge interface to the IWS which thus uses the indirect link connection via the PM and a wedge DD. The 3M™ CR100 Document Reader can also present a direct link interface to the IWS via a standard DD.

7 ARINC MUSE® PROTOCOL

The 3M™ CR100x OCR/MSR Document Reader conforms to the “PCP Peripheral Interface Specification Peripheral Vendors Document No. 730-PER-VENDOR" version 8. A copy of this specification is only available from Rockwell Collins.

The specification defines a logical link layer that allows the reader to communicate to the application, which is usually MUSE’s Peripheral Control Point (PCP). The logical link layer supports multiple devices; MSR, BCR and OCR. The 3M™ CR100x OCR/MSR Document Reader fully support all layers defined in the specification.

Appendix A – Character Sets

All characters are transmitted as ASCII data. However specific characters have special meanings according to the associated device. These are detailed below:

DEVICE C : CREDIT CARDS

Character Set

space $ ( ) /	\x20 "$" "(" ")" "/"
0 to 9	"0" to "9"
A to Z	"A" to "Z"

Special Characters

Track separator	","
Checksum error	"*"

DEVICE O : OPTICAL READER

OCRB Character Set

0 to 9	"0" to "9"
A to Z	"A" to "Z"
<	"<"
Unrecognised Characters	"_"

E13B Character Set

0 to 9	"`" to "i" = "0"+\x30 to "9"+\x30
E13B S1 Symbol 1	"q" = "A" +\x30
E13B S2 Symbol 2	"r" = "B" +\x30
E13B S3 Symbol 3	"s" = "C" +\x30
E13B S4 Symbol 4	"t" = "D" +\x30
Unrecognised characters	"_"

IBM OCR-A, 1403-M and 407E-1 Character sets	Transmitted as
0-9	"0" to "9"
OCR target ⊙	"x"
OCR lozenge ▭	"y"
OCR bar	"z"
Unrecognised characters	"_"

IATA Barcode

0-9	"0" to "9"

Appendix B – Test Card Configuration of RTE Protocol

The preferred method of configuration is the 3M CR Series Config Utility (See section 8.2 of the 3M™ CR100 Document Reader and 3M™ CR100M OCR/MSR Document Reader Getting Started Guide). However a legacy method is to use paper test cards, these can be useful if upgrading in the field without access to a computer.

1) Special Test Cards
   Test cards can be used to configure the various modes of the RTE Protocol. These cards are swiped through the reader and data is output indicating the success or otherwise of the operation. The following cards are available:

CV00	View configuration
CS00	Configure for RTE Native mode, BCC off
CS10	Configure for RTE Interrupt mode, BCC off
CS11	Configure for RTE Interrupt mode, BCC on
CS20	Configure for RTE Polled mode, BCC off
CS21	Configure for RTE Polled mode, BCC on

Special Test Cards

These test cards may be used to configure the reader. Photocopy this page (do not use a colour photocopier) and carefully cut the card out (the size must be 125 x 88 mm). For the best durability, laminate the paper or alternatively stick to card before cutting.

3M IDENTITY MANAGEMENT

Special test Card CV00

Reader Application – View Configuration

PTXLD<<<<RTE<TEST<CARD<<T<<DRAC<TSET<ETR<<<<
TRYOOCVOOOXLDOOOOOOO<<<<<<<<<<<<<<<<<<<<<<<0

3M IDENTITY MANAGEMENT

Special test Card CS00

Reader Application – Set Configuration
Configure for RTE Native, BCC off.

PTXLD<<<<RTE<TEST<CARD<<T<<DRAC<TSET<ETR<<<<
TRYOOCSOOOXLDOOOOOOO<<<<<<<<<<<<<<<<<<<<<<<0

3M IDENTITY MANAGEMENT

Special test Card CS10

Reader Application – Set Configuration
Configure for RTE Interrupt, BCC off.

```
PTXLD<<<<RTE<TEST<CARD<<T<<DRAC<TSET<ETR<<<<
TRY00CS100XLD0000000<<<<<<<<<<<<<<<<<<<<<<0
```

3M IDENTITY MANAGEMENT

Special test Card CS11

Reader Application – Set Configuration
Configure for RTE Interrupt, BCC on.

```
PTXLD<<<<RTE<TEST<CARD<<T<<DRAC<TSET<ETR<<<<
TRY00CS110XLD0000000<<<<<<<<<<<<<<<<<<<<<<0
```

3M IDENTITY MANAGEMENT

Special test Card CS20

Reader Application – Set Configuration
Configure for RTE Polled, BCC off.

```
PTXLD<<<<RTE<TEST<CARD<<T<<DRAC<TSET<ETR<<<<
TRYOOCS200XLDOOOOOOO<<<<<<<<<<<<<<<<<<<<<<O
```

3M IDENTITY MANAGEMENT

Special test Card CS21

Reader Application – Set Configuration
Configure for RTE Polled, BCC on.

```
PTXLD<<<<RTE<TEST<CARD<<T<<DRAC<TSET<ETR<<<<
TRYOOCS210XLDOOOOOOO<<<<<<<<<<<<<<<<<<<<<<O
```

Appendix C – ASCII Tables

ASCII CONTROL CHARACTERS

Name	Description (Type)	DEC Code	HEX Code
NUL	Null	0	00
SOH	Start of heading	1	01
STX	Start of text	2	02
ETX	End of text	3	03
EOT	End of transmission	4	04
ENQ	Enquiry	5	05
ACK	Acknowledge	6	06
BEL	Bell	7	07
BS	Backspace	8	08
HT	Horizontal tab	9	09
LF	Line feed	10	0A
VT	Vertical tab	11	0B
FF	Form feed	12	0C
CR	Carriage return	13	0D
SO	Shift out	14	0E
SI	Shift in	15	0F
DLE	Data link escape	16	10
DC1	Device control 1	17	11
DC2	Device control 2	18	12
DC3	Device control 3	19	13
DC4	Device control 4	20	14
NAK	Negative acknowledge	21	15
SYN	Synchronous idle	22	16
ETB	End transmission block	23	17
CAN	Cancel	24	18
EM	End of medium	25	19
SUB	Substitute	26	1A
ESC	Escape	27	1B
FS	File separator	28	1C
GS	Group separator	29	1D
RS	Record separator	30	1E
US	Unit separator	31	1F
DEL	Delete	127	7F

ASCII STANDARD CHARACTER SET

ASCII	DEC	HEX	ASCII	DEC	HEX	ASCII	DEC	HEX
<space>	32	20	@	64	40	`	96	60
!	33	21	A	65	41	a	97	61
"	34	22	B	66	42	b	98	62
#	35	23	C	67	43	c	99	63
$	36	24	D	68	44	d	100	64
%	37	25	E	69	45	e	101	65
&	38	26	F	70	46	f	102	66
'	39	27	G	71	47	g	103	67
(	40	28	H	72	48	h	104	68
)	41	29	I	73	49	i	105	69
*	42	2A	J	74	4A	j	106	6A
+	43	2B	K	75	4B	k	107	6B
'	44	2C	L	76	4C	l	108	6C
-	45	2D	M	77	4D	m	109	6D
.	46	2E	N	78	4E	n	110	6E
/	47	2F	O	79	4F	o	111	6F
0	48	30	P	80	50	p	112	70
1	49	31	Q	81	51	q	113	71
2	50	32	R	82	52	r	114	72
3	51	33	S	83	53	s	115	73
4	52	34	T	84	54	t	116	74
5	53	35	U	85	55	u	117	75
6	54	36	V	86	56	v	118	76
7	55	37	W	87	57	w	119	77
8	56	38	X	88	58	x	120	78
9	57	39	Y	89	59	y	121	79
:	58	3A	Z	90	5A	z	122	7A
;	59	3B	[	91	5B	{	123	7B
<	60	3C	\	92	5C	|	124	7C
=	61	3D	]	93	5D	}	125	7D
>	62	3E	^	94	5E	~	126	7E
?	63	3F	_	95	5F			