SEPAY Electronic Cash Register (ECR) Specifications

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Author Erik van Loenen
SEPAY B.V.

Version history

1.0 December 20, 2018
First draft

1.1 January 25, 2019
Removed TerminalID, MerchantID and Brand from response buffer and added ECRRef and MerchantRef. Some fields have been reordered.

1.2 January 31, 2019
Corrected order in Transaction response and added error code

1.3 February 5, 2019
Added definitions for new response codes:
01 Host timeout
02 Transaction aborted by terminal (STOP key)

1.4 May 14, 2019
Added version information for Check Connection command

1.5 July 15, 2019
Minor corrections:
3.2
- Response to Payment and Refund may contain 'X' (0x58) in the command field, which should be accepted as well
3.2.1
- Incorrect order of first two fields corrected
- Length of datetime field corrected
- Added response code for 'Card decline'
3.2.3
- Length of response code corrected

1.6 July 23, 2019
Changed maximum length of ECR Ref and Merchant Ref to 12 characters

1.7 October 31, 2019 Erik van Loenen
Add ACK/NACK/ENQ/BUSY to verify messages and test terminal status.

1.8 January 23, 2020
Added command 0x95 to switch the 'Extende mode'

1.8 March 3, 2020
Rewrite to support new implementation of flow control

2.0 March 28, 2020
Latest changes matching implementation in application version 200327 or newer

1 Introduction

This document describes the implementation of the ECR protocol with the NexGo T2 fixed (Ethernet) terminals. The mobile terminals (G2/K300) actually work as well, but are obviously not ‘practical’ to use for a fixed ECR setup.
The connection between the ECR system and the NexGo terminal is established with an RJ45 to male DB9 or USB by using a serial to USB converter which emulates a serial port on a PC.

This specification is split into 2 parts. The first part describes the ECR related options that are implemented on the terminal. The second part describes the commands that the terminal can accept on the serial port and will respond to.

<nice picture here later>

2 ECR and the terminal

2.1 Operation mode

The terminal can be set to operate in one of the following modes:

1. TERMINAL ONLY
2. ECR ONLY
3. TERMINAL + ECR

TERMINAL ONLY mode

This is the 'normal operation' mode of each terminal. The terminal will accept input from the keyboard. Also the 'normal' menu and System menu are available. ECR connection is not active.
This mode can be set by sending command 0x96.

ECR ONLY mode

When in ECR mode, the terminal should not accept input from the keyboard unless the ECR system started a transaction. The Payment Menu (F3) is not available and when the System Menu key (F1) is pressed, a password is requested before showing the system menu. This is the same password that opens the 'ECR MODE' menu in the COMMUNICATION menu.
This mode can be set by sending command 0x97.

TERMINAL + ECR mode

In this mode, the terminal can accept input from both the ECR or the keyboard/menu. When a transaction is performed directly from the keyboard, the ECR system will not be 'aware' of this transaction!
This mode can be set by sending command 0x98.

2.2 Communication mode

Regarding ECR, the terminal can operate in two communication modes:

1. Extended commands enabled
2. Extended commands disabled

The default is disabled, for backward compatibility. This means that messages are sent/received without confirmation and are assumed to arrive at the other end.

When enabled, the preferred mode, both the terminal and the ECR should send one of two answers for each command/message received:

ACK (0x06) Message is received correctly and will be processed.

NACK (0x15) Message is not received correctly.

If a NACK message is received, or there is no response within 2 seconds after sending the message, the same message is sent again. The maximum number of retries is set to 3. The same message is never sent more than four times.

The following commands don't require and ACK/NACK, but just an answer to the command itself. These are the commands that don't do any processing and basically can respond with the answer instantly. In the explanation of the commands later in this document, these commands are marked as '**[S]**'.

2.3 Terminal menu

The mode can also be switched on the terminal itself from the following path:

- F1 (SYSTEM MENU)
- 2. COMMUNICATION
- 6. ECR MODE
- INPUT PWD: 7327
- ECR MODE
  - 1 – TERMINAL ONLY
  - 2 – ECR ONLY
  - 3 – TERMINAL + ECR

After selecting the desired mode (or pressing OK to keep the current mode), the terminal will display the following menu:
EXT COMMAND:

- 0 - DISABLE
- 1 – ENABLE

This will determine whether or not the terminal will first send ACK/NACK response after receiving the commands and also if the ECR should send ACK/NACK after receiving data from the terminal. Note that commands marked as '**[S]**' in the list later in this document do not use extra ACK/NACK messages, because they are 'simple' commands.

After selecting the desired mode, the following menu is shown:

ENABLE BLUETOOTH:

- 0 – NO
- 1 – YES

The terminal also supports a keyboard (Merchant Amount Unit) to be connected to the RS232 port. The terminal will automatically detect what is connected, after receiving a command from the ECR. Once the terminal has switched to ECR mode, the terminal will remain in that mode until a keyboard is connected and a command is given from that keyboard. **TODO**: verify which commands the terminal recognizes, maybe only specific commands automatically switch the terminal to ECR mode when previously in Keyboard mode or confirm they all do

The 'ECR MODE' and 'EXT COMMAND' options can be controlled by commands from the ECR. It is advised to set the desired modes for this when (re)connecting to the terminal from the ECR, so the terminal can safely assume the correct mode from the terminal.

In case the terminal has a BlueTooth module, it can be turned on or off. Off course, when not used, it should be turned off to save (battery) power. It is off by default. BlueTooth specs are in development and not yet tested. So far, none of the terminals delivered by Sepay contain a BlueTooth module, so the setting is irrelevant.

TERMINAL ONLY mode

This is the 'normal operation' mode of each terminal. The terminal will accept input from the terminal keyboard. Also the 'normal' menu and System menu are available. ECR connection is not active.

ECR ONLY mode

When in ECR only mode, the MENU key label on the terminal will not be visible (right most function key below the screen). When this key is pressed anyway, the ECR password will must be entered before the user can start a transaction from the terminal. Also, the System Menu is protected by the same password. This is the same password that opens the 'ECR MODE' menu in the COMMUNICATION menu (see above).

TERMINAL + ECR mode

In this mode, the terminal can accept input from both the ECR or the terminal keyboard/menu. When a transaction is performed directly from the terminal keyboard, the ECR system will not be 'aware' of this transaction!

EXT mode disabled

In this mode, the terminal will not send ACK/NACK message as a response to commands received from the ECR. Also, the terminal does not expect ACK/NACK messages from the ECR after sending commands to the ECR.
Note that this ACK/NACK is not used for commands that can be executed instantly on the terminal. In the explanation of the various commands, it is indicated (**[S]**) whether or not an ACK/NACK is expected to confirm receipt of the message.
For backward compatibility, this is the default mode.

EXT mode enabled

The terminal will respond with an ACK/NACK when it receives a command from the ECR. Also, the ECR should send an ACK/NACK when it receives a message from the terminal.
Note that this ACK/NACK is not used for commands that can be executed instantly on the terminal. In the explanation of the various commands, it is indicated whether or not an ACK/NACK is expected to confirm receipt of the message.

The preferred mode for ECR systems is always EXT mode enabled. Basically, the ECR should initialize the desired ECR mode (Terminal only, ECR only or both) as well as the EXT mode enable/disable on startup to ensure proper operation of the terminal.

3 ECR Terminal Protocol

The functionality of the Sepay ECR protocol consists primarily of starting/initiating a transaction on the terminal with the desired amount and a given ID. The transaction can either be a payment or a refund. The terminal will then follow the payment flow, until payment is successful or otherwise ended.

In certain states, the ECR can also cancel the transaction. Once the transaction is in progress (a card has been read), the transaction cannot be canceled from the ECR anymore.

Also, the interface allows the ECR to request the status of a transaction that was started earlier by passing the unique ID of the transaction. This ID is the ID that was sent with the payment or refund command earlier and this must be unique per ' logical terminal'.

The interface also allows the terminal to switch 'ECR MODE' (see previous chapter) and enable or disable EXT mode from the ECR.

Finally, there is a command to check the status of the connection from the ECR to the terminal and also the status of the connection from the terminal to the payment gateway.

If the EXT mode is enabled, the terminal can also send an ENQ command to check if the terminal is ready to receive commands. It is advised to always send an ENQ command and waiting for the answer before sending any other/'real' commands to the terminal. The exception could be the CANCEL command, where the ECR can always simply attempt to cancel the transaction. The answer from the terminal, or timeout, will tell the ECR whether or not the transaction was canceled or not (because it was already in progress).

3.1 Implementation

The way the ECR can communicate with the terminal is by sending a stream of data/bytes to the terminal. The terminal in turn, after the command is processed or transaction has finished will return a stream of data/bytes back to the ECR system. Payment and refund commands can take up to a minute (in exceptional cases), so the timeout when waiting for a response should be long enough. The Check Transaction command can take up to 10 seconds (usually less than 1 second though), the other commands should response within about 1-3 seconds. These are estimates that need to be validated, but should give a basic idea.
All communication between terminal and ECR, including the ACK/NACK message, is embedded in a packet with the structure as described in the table below:

Data structure sent to or received from the terminal

STX	LEN	CMD	FLAG	CONTENT	ETX	LRC
0x02	2 bytes	1 byte	0x7C ('|')	n bytes	0x03	1 byte

STX Start of byte data stream

LEN Length of CMD + FLAG + CONTENT. First byte: LEN / 256, second byte LEN % 256.

CMD Command requested from terminal. See further, where each command is explained

FLAG Flag separating fields

CONTENT Content of the message that differs depending on the command. Details explained later per command

ETC End of data stream

LRC Checksum, this is an XOR of all bytes from STX to ETX

3.2 Commands supported

This chapter describes the supported commands and the associated CONTENT of both sent and received data from terminal. The response to a payment or refund, may have 'X' in the response for the command, so these commands should also allow 'X' (0x58) as valid as a reply to these commands.
The commands marked with **[S]** (Simple commands) do not require a separate ACK response, but will directly receive the response to the command with the value of the command in the CMD field. When in EXT mode, commands not marked with **[S]** will require an ACK message from the terminal when the command is sent to the terminal. Similarly, for messages received from the terminal, except ACK commands/messages, the terminal should send an ACK (or NACK on failure) to the terminal to indicate the command was received.
Below is a short summary of the commands, followed by paragraphs describing the details.

0x01 Payment: this is the command to start a regular payment on the terminal

0x02 Refund: this is the command to start a refund on the terminal (may not be supported on terminal)

0x03 Check: With this command, the status/result of a previous transaction can be checked

0x04 Cancel current payment/refund request (can only be processed if the transaction is not yet in progress)

0x05 **[S]** ENQ: check if terminal is ready for commands

0x94 **[S]** Switches terminal to simple communication mode

0x95 **[S]** Switches terminal to extended communication mode

0x96 **[S]** Switches terminal to Terminal Only mode (no support for payments from ECR)

0x97 **[S]** Switches terminal to ECR Only mode (no payment can be started from the terminal)

0x98 **[S]** Switches terminal to Combined mode, allowing transactions from both ECR and terminal

0x99 Check connection: Used to check if the terminal responds and is functioning properly

3.2.1 0x01 Payment, 0x02 Refund and 0x03 Check Transaction

The Payment and Refund commands have almost the same 'CONTENT' definition which is described below.
The Refund has and extra field (RefundPassword) that can be omitted (or will be ignored) for Payments.

The Check Transaction command only requires the 'ECRRef' field, the rest can be omitted.
Each field in the table below is separated by the '|' sign (0x7C).

Amount	N[12]	Amount of the transaction in cents
ECRRef	A[0-12]	Unique reference generated by ECR. This can be used in the Check (0x03) command
MerchantRef	A[0-12]	Value to be stored with the transaction as the Merchant Reference
PrintTickets	N[1]	Controls whether ticket(s) are printed on the terminal or not: **0**: No ticket, **1**: Cardholder ticket, **2**: Merchant ticket, **3**: both tickets
RefundPassword	N[5]	5 digit password required for Refund (can be omitted for Payment)

An example CONTENT for starting a Payment transaction of €12,34 could be:

```
000000001234|ECR123|MRCHT45|0
```

A refund example for the same amount:

```
000000001234|ECR124|MRCHT46|1|12345
```

The CONTENT for the response from the terminal us described in the table below. In case the transaction is not successful (ResponseCode is not '00') the other fields will not be present (or can be ignored). The ResponseCode field is applicable for all commands. The Payment, Refund and Check Transaction commands all have the same CONTENT definition:

ReponseCode	A[2]	Indicates if the transaction was successful: **00**: Successful, others indicate error (to be specified) The Status, ResultCode and ErrorCode fields provide more technical details about the reason the transaction failed **01**: Host timeout / no response from host **02**: Transaction aborted by terminal (STOP key) **03**: Card decline
Amount	N[12]	Amount of the transaction in cents
Status	A[0-20]	Provides 'A' indicates success, all other values mean the transaction was not successful
ResultCode	A[0-20]	Result code can contain code in case of failed transaction (details to be provided later)
ErrorCode	N[1-4]	Code indicating the background of the error (see Appendix A)
Datetime	N[14]	Time of transaction: yyyyMMddhhmmss
ECRRef	A[1-12]	Unique reference generated by ECR (should be copied form transaction that was started)
MerchantRef	A[0-12]	Value stored with the transaction as the Merchant Reference (Optional)
TicketInfo	A[0-9999]	Representation of the proof of payment ticket to be printed

An example CONTENT for a successful Payment transaction of €12,34 could be:

```
00|000000001234|A|||20181219120102|ECRREF|MERCHANTREF|ticket info todo
```

When transaction is declined by for some other reason (incorrect PIN, insufficient balance, etc), the CONTENT could be something like:

```
00|000000001234|D||121|20181219120102|ECRREF|MERCHANTREF|
```

Important to note here is that that the Status of ´A´ means successful, all other status values mean the transaction was not successful. Also, in that case the amount may not be properly set.

When a timeout occurred, the CONTENT looks like this:

```
01|
```

When the transaction was stopped on the terminal the CONTENT looks like this:

02 |

3.2.2 ECR CANCEL transaction command (0x04)

This command can only be sent if a transaction has been started on the terminal, but is not yet 'in process'. Most commonly this command can be used when the terminal is waiting for a card to start the transaction.
When the cancel was successful, the response from the terminal will contain the cancel command (0x04) and the response code will be '00'. If the cancel could not be processed, there will be a timeout, or the response code will contain ' 01'.

If the command is sent while there is no transaction in progress, the terminal will respond with a cancel response as if a transaction was canceled successfully (command cancel and response code '00').

3.2.3 Extended Mode switching commands (0x94 and 0x95)

To disable extended mode, send command 0x94, to enable send command 0x95. The messages have no CONTENT. The terminal should respond with the same command with response code '00' to indicate everything is OK.
So the CONTENT in the response contains only one field:

ResponseCode	A[2]	Indicates whether command succeeded (00) or not (some other value)

3.2.4 ECR Mode switching commands (0x96, 0x97 and 0x98)

The three ECR mode switching commands have no CONTENT when sent to the terminal. The CONTENT in the response contains only one field:

ResponseCode	A[2]	Indicates whether command succeeded (00) or not (some other value)

3.2.5 Check connection (0x99)

This command also has no CONTENT when sent to the terminal. The CONTENT in the response contains:

ResponseCode	A[2]	Indicates whether command succeeded (00) **01**: Connection to terminal OK, but no connection to payment gateway can be made (if supported). This would usually indicate a configuration error on the terminal. If there is no connection to the terminal at all, the command will timeout or cause some other error. NOTE: We usually provide the 'version' of the terminal as <ApplicationVersion>/<ConfigVersion>, so for example: 190403/19
ApplicationVersion	A[0-20]	**(NOT YET IMPLEMENTED)** Version of the application running on the terminal. The format of the version is yymmdd
ConfigVersion	N[1-4]	**(NOT YET IMPLEMENTED)** Version of the configuration that the terminal is running

Appendix A. Error codes

Code	Description	Result
000	Approved	Approved
001	Honour with identification	Approved
002	Approved, partially	Approved
003	Approved, VIP	Approved
005	Approved, account type specified by card issuer	Approved
006	Approved for partial amount, account type specified by card issuer	Approved
007	Approved, update ICC	Approved
099	Approved, no loyalty	Approved
100	Do not honour	Declined
101	Expired card	Declined
103	Card acceptor contact acquirer	Declined
104	Restricted card	Declined
106	PIN tries exceeded	Declined
107	Refer to card issuer	Declined
109	Invalid merchant	Declined
110	Invalid amount	Declined
111	Invalid card number	Declined
112	PIN data required	Declined
114	No account of type requested	Declined
115	Requested function not supported	Declined
116	Not sufficient funds	Declined
117	Incorrect PIN	Declined No PIN retry
118	No card record	Declined
119	Transaction not permitted to cardholder	Declined
120	Transaction not permitted on terminal	Declined
121	Exceeds withdrawal amount limit	Declined
123	Exceeds withdrawal frequency limit	Declined
125	Card not effective	Declined
126	Invalid PIN block	Declined
127	PIN length error	Declined
128	PIN key synch error	Declined
160	Exceeds day (24h) amount limit	Declined
161	Exceeds week (24*7) amount limit	Declined
162	Exceeds month (24*30) amount limit	Declined
163	Exceeds day (24h) frequency limit	Declined
164	Exceeds week (24*7) frequency limit	Declined
165	Exceeds month (24*30) frequency limit	Declined
180	Redemption denied by Loyalty	Declined
181	Card blocked	Declined
182	Account blocked	Declined
185	Product not allowed	Declined
190	Unknown transponder	Card blocked
191	Unknown POS terminal	Declined
192	Illegal challenge response	Declined
200	Pick-up card	Declined
201	Expired card, pick-up	Declined
202	Suspected fraud, pick-up	Declined

203	Contact acquirer, pick-up	Declined
204	Restricted card, pick-up	Declined
206	PIN tries exceeded, pick-up	Declined
207	Special condition, pick-up	Declined
208	Lost card, pick-up	Declined
209	Stolen card, pick-up	Declined
299	Refund+ limit reached	Declined
400	Reversal approved	Approved
480	Reversal approved, no original transaction	Approved
500	Reconciliation in balance	Approved
501	Reconciliation out of balance	Approved (used by EquensWorldline)
580	Reconciliation out of balance	Approved (not used by EquensWorldline)
800	Network management message accepted	Approved
902	Invalid transaction	Failed
903	Re-enter transaction	Failed
904	Format error	Failed
906	Cut-off in progress	Failed
907	Issuer or switch inoperative	Failed
909	System malfunction	Failed
911	Card issuer timed out	Failed
912	Card issuer unavailable	Failed
916	Message authentication code failure	Failed
917	MAC key synch error	Failed

Appendix B. Flow samples

These examples show the flow in case Extended Mode is enabled.

Test if terminal is available, terminal may not be able to answer in all states

Scenario	ECR		Terminal (command + response code)	
A	ENQ	→		
		←	ENQ + 00	Terminal is ready to accept messages
B	ENQ	→		
		←	ENQ + 01	Transaction in progress, cannot cancel

Payment/Refund, re-send messages

ECR		Terminal	
ENQ	→		
	←	ENQ + 00	Terminal is ready to accept message.
	….		
Message	→		
	←	NACK	Message not received
Message	→		1st retry, re-send message
	←	ACK	Message received
ENQ	→		
	←	ENQ + 01	Transaction in progress
	….		
	←	Message	Payment/Refund result
NACK	→		Message not received
	←	Message	1st retry, re-send message
NACK	→		Message not received
	←	Message	2nd retry, re-send message
ACK	→		Payment/Refund result accepted in ECR

Payment/Refund CANCEL

ECR		Terminal	
ENQ	→		
	←	ENQ + 00	Terminal is ready to accept message.
	….		
Message	→		Start transaction
	←	ACK	Message received
	….		
CANCEL message	→		Abort transaction
	←	ACK	Message received
	←	CANCEL+ 00	Confirm cancellation of transaction
ACK	→		Cancel accepted from terminal

Check connection

ECR		**Terminal (command + response code)**	
Command 0x99	→		
	←	ACK	Message received
	←	0x99 + 00	Connection result message
ACK	→		

Enable Extended mode (disable works similarly)

ECR		**Terminal**	
Command 0x95	→		
	←	0x95 + 00	Extended mode command accepted

Switch to ECR only mode (Terminal only mode and combined mode work similarly)

ECR		**Terminal**	
Command 0x97	→		
	←	0x97 + 00	Extended mode command accepted