

NGPCL Usage Guide

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1 Introduction

This document describes the NGPCL language that is used to connect a NextGen based printer to simple line control equipment. This equipment is typically PLC based and is not capable of handling the more complex DCP protocol used by the links to the SmartTouch and the HostPC.

NGPCL is a Markem NextGen protocol that is not adopter specific. The first release of the design of the protocol meets the requirements laid down in the 'SmartDate5 Requirements Specification'. Additional features may be added to support other adopters.

NGPCL has evolved from the ASCII comms protocol currently in use on the SmartDate 2/3.

NGPCL shall contain a limited number of commands using the same format as the existing SmartDate 2/3 to allow existing users an easier upgrade path. These commands compromise the functionality of the NextGen device and new users should be encouraged to use the new commands. For details see ngpcl_legacy_pfs.doc.

1.1 Document Standards

ASCII/Unicode characters are denoted using single quotes. For example 'A' denotes the ASCII/Unicode character A which has the decimal value 65.

The NULL character (transmitted as the value 0) is denoted using '\0'.

2 Design Principles

The following design principles are to be adopted.

- All commands to the printer (NGE device) shall not require the control system to process a reply although a reply will be sent to allow secure processing.
- Fields within the NGPCL protocol shall be of a fixed field size wherever possible from the NGE device since PLCs have difficulty understanding variable length field messages.
- NGPCL shall be designed to work over slower RS232 links (typically 9600 baud).
- The messages shall be simple for the control equipment to generate and for the control equipment to decode. This shall take precedence over making the commands compact and easy to generate for the NGE device.
- Only one NGPCL link shall be available at any one NGE device.
- All NGPCL 'conversations' shall be initiated by the external control equipment.

3 Physical Layer

NGPCL may use either RS232 links or Ethernet links

3.1 RS232

RS232 shall be used without any handshaking (hardware or software).

The UART shall be configured to 8 data bits, 1 stop bit and no parity.

Baud rate shall be configurable, but shall be the same for both transmit and receive.

3.2 Ethernet

Both NextGen device and remote controller shall have a configurable fixed IP address.

NGPCL shall always use port 21,000.

Note, when using a fixed IP address the NG device will not be able to communicate with a SmartTouch.

4 Protocol Structure

All messages, both to the NGE device and to the control system, shall have the following structure:

Packet Start	Message Number	Message Identifier	Message Body (optional)	Packet End
--------------	----------------	--------------------	-------------------------	------------

The 'Packet Start' shall be a unique ASCII control character unused elsewhere in the protocol.

The 'Packet End' shall be a unique ASCII control character unused elsewhere in the protocol.

The Message Number is an optional fixed length field. It may be logged by the NGE device and used to track job selects. It shall be 4 numeric characters. If it is included in a message to an NGE device it shall be sent in the response to that message.

The 'Message Identifier' shall be a fixed length, (3-character) sequence. The sequence shall always start with the same Message Identifier character.

The size of the Message Body shall be dictated according to message type (as denoted by the Identifier). A command message does not always require a Message Body. A Response or Reply message shall always have a body.

A packet shall only contain one message.

The Message Identifier and the Message Body may be repeated between Packet Start and Packet End in messages sent to the NG Device as shown in the diagram below:

Packet Start	Message Number	Message Identifier	Message Body (optional)	Message Identifier	Message Body (optional)	Packet End
--------------	----------------	--------------------	-------------------------	--------------------	-------------------------	------------

Within a message body fields will be separated by the delimiter character. The delimiter must not appear within message body fields. A delimiter character appears at the end of each message body.

All fixed length numeric fields sent from the NG device shall be padded by inserting leading zeros. Numeric strings received by the NG device may be padded using leading zeros, leading spaces, training spaces or trailing nulls. The example below shows the value 100 being sent as a fixed length 9-character string:

'0'	'0'	'0'	'0'	'0'	'0'	'1'	'0'	'0'
' '	' '	' '	' '	' '	' '	'1'	'0'	'0'
'1'	'0'	'0'	' '	' '	' '	' '	' '	' '
'1'	'0'	'0'	'\0'	'\0'	'\0'	'\0'	'\0'	'\0'

The following control characters are defined:

Control Character	Preferred Values				Legacy values	
	Printable (default)		Traditional			
	ASCII Value	Decimal Equivalent	ASCII Value	Decimal Equivalent	ASCII Value	Decimal Equivalent
Packet Start	{	123	STX	2	^A	1
Delimiter		124		124		124
Message Start	~	126	~	126	^	136
CheckField Start		124		124	-	-
Packet End	}	125	ETX	3	^Z	26

Three sets of control characters are defined. 'Preferred' values are to be used for all new installations, while 'Legacy' values allow NextGen devices to work in older installations. Within the Preferred section, two sets of packet delimiters are defined. The Printable set (curly brackets) is used when the protocol needs to be viewed/simulated using a standard Windows terminal emulator (e.g. HyperTerminal). The Traditional set (STX/ETX) can be used where link security is the overriding requirement, as these characters are less likely to be accidentally included in a field's text, or elsewhere in the message.

The NextGen device will support a setting allowing the user to select the 'Preferred' control character set used. This setting shall default to the Printable setting. The NG device shall always respond using the same control characters as those in the initiating message, as set via the device setting.

The 'Legacy' control characters may only be used in conjunction with the Legacy commands. The NG device shall respond using the same control characters as those in the initiating message.

It is the user's responsibility to ensure the control characters are not used within the image design. The control characters have been chosen to minimise this occurrence.

The Checkfield is optional. The Checkfield consists of a 'Checkfield Start' character followed by a fixed length numeric field, 3 digits long. The Checkfield is calculated on the characters between (but not including) the Packet Start and the Checkfield Start. The NextGen device will support a setting allowing the user to enable the checkfield. Once enabled the checkfield must be included in every message received by the NextGen device and the device will include the Checkfield in all messages it sends.

The Checkfield is calculated by summing the decimal values of each ASCII character to be checked and taking the mod 1000 of the result. If the resulting value is less than 3 digits then it is padded to 3 digits using leading zeros. A worked example can be found in section 7.

4.1 Message Security

The application receiving the message shall successfully parse the complete message and validate any checkfield before any data within the message is actioned. If either the parsing or the checkfield fails the receiving application shall respond with the NAK message.

4.2 Field Length

PLCs have difficulty handling variable field lengths. The NextGen IDM model does not limit the length of job names, field names and field values. The user is at liberty to apply their own limit to field length at image design time. To allow fixed length fields to be sent to the NextGen device the sending device may pad strings by appending null (decimal value 0) characters to strings shorter than the fixed size. The NextGen device will strip off these padding characters.

The NG device can be programmed to force field strings to fixed lengths. Two machine settings are required to specify Field Name length and Field Value length. If the setting is 0 then the field value is sent as a variable length value. If the setting is non-zero then the field is forced to the required length. If the field is longer than the setting it is truncated. If the field is shorter than the setting then it is padded up to the correct length using null characters.

4.3 Unicode

To use the full NextGen feature set the control system must support Unicode. However PLC systems may not support Unicode, or the application may not require Unicode. A machine setting will control the use of Unicode.

If Unicode is enabled all received and transmitted characters on the NGPCL link will be sent as 16 bit Unicode characters.

If Unicode is disabled all data shall be sent and received as 8 bit ASCII characters. The user should ensure that their images and jobs do not require use of the full Unicode character set.

4.4 Message Types

4.4.1 Command

A Command is sent to the NG device to instruct it to take an action.

The NG device shall respond to a Command by returning the message identifier.

The NG device can be instructed (as part of the command) to delay the reply until the action has completed (or failed to complete). If the NG device receives another NGPCL message before it has replied it will cancel the pending reply.

The reply shall always have a single character success code that shall be '0' for success and '1' for command failed.

4.4.2 Request

A Request is sent to the NG device to ask for information. It will not initiate an action. A Request always expects a Response.

4.4.3 Response

A Response is sent by the NG device following a Request.

Optionally a response shall have a single character status code that shall be '0' for success and '1' for response failed. A setting allows this feature to be turned on or off for all responses. The default is controlled by the NG adopter. The recommendation is for this setting to default to 'on'.

Note

There are no unsolicited responses sent by the NG device.

4.5 Line Reference

NextGen devices with multiple print heads may have more than one job. Heads may be grouped and jobs assigned to the head groups. A group of heads will be referred to by a unique identifier string known as the 'Line Reference'. Line reference strings are configured within the NextGen device.

Line Reference strings appear as elements within commands. The NextGen device will only reply if the element matches a valid group of heads. For single head machines the Line Reference element will be blank (a zero length string). The element may not be omitted.

5 Message Definitions

The following message are defined:

5.1 NAK

Sent to or from the NGE device in following the failure of any packet to be correctly parsed or if the checkfield is incorrect

Response	Field	Field Length	Notes
Message Identifier	~NK		
Message Body	Status	1 character	Optional

The Status field will always have the value 1 indicating failure.

Example

~NK1|

5.2 Job Select

Sent to the NGE device to select a job

Command	Field	Field Length	Notes
Message Identifier	~JS		
Message Body	Reply Timing	1 character	0 – Reply immediately 1 – Reply when job imaged
	Job Name	Variable	
	Allocation	Variable, max 9 characters	0 = no allocation
	Variable Field Name	Variable	May be repeated. Must be sent as a pair.
	Variable Field Data	Variable	

The Reply Timing and Job Name fields are compulsory.

Subsequent fields are optional, however if an optional field is included all preceding fields must be included.

Example

~JS0|Job1|1|Field1|Field1Value|

Command Reply:

~JS0|

Notes: There is no restriction on the order of variable fields.

If any setting changes need to be associated with the job selection they can either be set up as part of the job or sent as an additional change setting command after the Select Job command.

5.3 Job Request

Sent to the NGE device to request the current job(s).

Request	Field	Field Length	Notes
Message Identifier	~JR		
Message Body	Line Reference	Variable	Blank if single head

The job is reported on a per Line Reference basis. For NG devices with only one head the field may be left blank. It must not be omitted. For NG devices with multiple heads the Line Reference must be valid or the request will fail.

Example

~JR|

This example shows a blank Line Reference.

5.4 Job Name

Sent by the NGE device in response to a Job Request to report the Job Name.

Response	Field	Field Length	Notes
Message Identifier	~JN		
Message Body	Status	1 character	Optional
	Job Name	Variable	The name of the current job

If there is no currently selected job on the specified line then the job name shall be blank and the 'status' field (if enabled) shall have a value of 1.

Example

~JNCurrentJob|

~JN0|CurrentJob| (if 'Status' field enabled)

5.5 Job Update

Sent to NGE device to update the currently selected job.

Command	Field	Field Length	Notes
Message Identifier	~JU		
Message Body	Reply Timing	1 character	0 – Reply immediately 1 – Reply when job imaged
	Job Name	Variable	
	Allocation	Variable max 9 characters	0 = no allocation
	Variable Field Name	Variable	May be repeated. Must be sent as a pair.
	Variable Field Data	Variable	

The Job Name field may be left blank when sent to NG devices that only support a single job.

The 'Field Name' and 'Field Data' fields are treated as a pair repeated a number of times.

Example

~JU0||001|Field1|Field1Value|

Command reply:

~JU0|

Only alphanumeric fields can be updated in using this message. The form of data source it internally uses also determines whether or not an alphanumeric field can be updated. The following rules apply:

Data Source	Updateable via NGPCL?	Syntax / data constraints
Static	No	N/A
UserInput	Yes	The field data must match the data validation mask defined by the image designer.
Merged	No	N/A
Calculated	Yes	The value must be between the minimum and maximum values specified by the image designer range limits
MachineSetting	No ¹	N/A.
UserPromptedDate	Yes	The field data must be a date formatted as YYYYMMDD. The date defined must be valid. If the range limits are defined by the image designer, then the date must fall within them.
TimeDate without OffsetRule	No	N/A
TimeDate with OffsetRule	Yes	The field data must be an offset formatted as DDD/MM/YY. If range limits are defined, the offset must fall within them
CalendarMaintainedDate	No	N/A

Note 1 - Also note that any changes to a setting will not be printed until a new job is selected.

5.6 Field Contents Request

Sent to NGE device to request the current value of a single field.

Request	Field	Field Length	Notes
Message Identifier	~FR		
Message Body	Job Name	Variable	
	Field Name	Variable	

The Job Name field may be left blank when sent to NG devices that only support a single job.

Example

~FR|Field1|

Note the blank job name field in the example.

If the Field Name is blank then the NG device will report all the fields within the specified job

Example

~FR|| All fields from currently selected job
~FRJob1|| All fields from Job1

5.7 Field Contents

Sent by NGE device in response to a Field Contents Request.

Response	Field	Field Length	Notes
Message Identifier	~FC		
Message Body	Status	1 character	Optional
	Field Name	See section 4.2	
	Field Data	See section 4.2	

Only one field is returned in this response. If the job name in the request is specified and does not match a selected job, or the field name in the request does not match a field name in the selected job then this message consists of a blank field name only.

Example:

~FCField1Name|Field1Value|
~FC0|Field1Name|Field1Value| (if 'Status' field enabled)

If the requested field does not exist the message will be:

~FC|
~FC1| (if 'Status' field enabled)

If the request specifies multiple fields the Field Name and Field Data fields are repeated as necessary.

~FCField1Name|Field1Value|Field2Name|Field2Value|

Note: For data from more than one field the user should use the logged field contents request or create a hidden merged field in the image and request that field.

5.8 Logged Field Contents Request

Sent to NGE device to request the current value of all fields marked for logging.

Request	Field	Field Length	Notes
Message Identifier	~FL		
Message Body	Job Name	Variable	

The Job Name field may be left blank when sent to NG devices that only support a single job.

Example

~FL|

Note the blank job name field in the example.

5.9 Logged Field Contents

Sent by NGE device in response to a Request Field.

Response	Field	Field Length	Notes
Message Identifier	~FV		
Message Body	Status	1 character	Optional
	Field Name	See section 4.2	Sent as a pair. One pair for each field marked for logging.
	Field Data	See section 4.2	

If there are not fields defined for logging in the requested job, or the requested job is not selected then a reply with a blank field name shall be sent.

Example:

~FVField1|Field1Value| Field3|Field3Value|

~FV0|Field1|Field1Value| Field3|Field3Value| (if 'Status' field enabled)

If there are no logged fields the message will be:

~FV|

~FV1| (if 'Status' field enabled)

5.10 Device Status Request

Sent to the NGE device to request it to report the machine status

Request	Field	Field Length	Notes
Message Identifier	~DR		
Message Body	Line Reference	Variable	Blank if single head

The status is reported on a per Line Reference basis. For NG devices with only one head the field may be left blank. It must not be omitted. For NG devices with multi heads the Line Reference must be valid or the request will fail.

Example

~DR|

The Line Reference in this example is blank, indicating a single head machine.

5.11 Device Status

Sent by the NGE device in response to a status request. Note all the values are specific to the Line Reference requested.

Response	Field	Field Length	Notes
Message Identifier	~DS		
Message Body	Status	1 character	Optional
	NGE device in producing state	1 character	'1' = producing, '0' otherwise
	NGE device in aborted state	1 character	'1' = aborted, '0' otherwise
	NGE device warning active	1 character	'1' = warning active, '0' otherwise
	NGE device imaging complete	1 character	'1' = image complete (reset to '0' by print go).
	Result of last job select or job update	1 character	0 = no select received 1 = processing 2 = complete and successful 3 = failed – allocation in progress 4 = failed – file missing
	Allocation in progress	1 character	'1' = allocation in progress, '0' otherwise
	Allocation remaining	9 characters	Set to 000000000 if no allocation.
	NGE device PackML state	2 characters	See section 6
	NGE device PackML mode	1 character	See section 6
Those settings above this line are standard to the NextGen core, those below are NextGen adopter specific. The Next Gen adopter is free to lengthen the message to add extra data. The Next Gen adopter is responsible for defining the extra data added.			
	Adopter Data		

Example:

~DS1|0|0|0|0|1|000000005|06|1|

~DS0|1|0|0|0|0|1|000000005|06|1| (if 'Status' field enabled)

5.12 Clear to Send Data Request

Sent to NGE device to request whether the last job selection or update has been printed (or started printing). It can be used to find out when the NG device is ready to accept the next Job Select or Job Update.

Request	Field	Field Length	Notes
Message Identifier	~DC		
Message Body	Response Timing	1 character	0 – Respond immediately 1 – Respond when clear to send data

Example

~DC0|

5.13 Clear to Send Data Response

Sent by NGE device in response to a Clear to Send Data Request.

Request	Field	Field Length	Notes
Message Identifier	~DV		
Message Body	Status	1 character	Optional
	Clear to Send status	1 character	0 – Ready to accept new data 1 – Not ready to accept new data

Example

~DV1|

~DV0|1| (if 'Status' field enabled)

Note: If the NextGen device is not in the Producing state this response will be returned immediately (whatever the value of the 'Response Timing' field in the request) and report 'Not Ready'.

5.14 Counts Request

Sent to NGE device to request the current counts values.

Request	Field	Field Length	Notes
Message Identifier	~CR		
Message Body	Line Reference	Variable	Blank if single head

The counts is reported on a per Line Reference basis. For NG devices with only one head the Line Reference field may be left blank. It must not be omitted. For NG devices with multi heads the Line Reference must be valid or the request will fail.

Example

~CR|

The Line Reference in this example is blank indicating it comes from a single head device.

5.15 Counts Values

Sent by NGE device in response to a 'Request Counts' message

Response	Field	Field Length	Notes
Message Identifier	~CV		
Message Body	Status	1 character	Optional

	Count Type	5 Characters	A code defining the count type
	Count Value	9 Characters	

Count Type and Value will be repeated within the message body.

Example

~CVTOTAL|000000000|BATCH|000000000|

~CV0|TOTAL|000000000|BATCH|000000000| (if 'Status' field enabled)

The number of counts reported will be defined by the adopter project. The NextGen core defines the following counts that shall always be sent (in this order first):

Count	Count type code
Total Print Count	TOTAL
Batch Print Count	BATCH

5.16 Setting Change

Sent to NGE device to change the value of a single setting. The requirements outlined in the NGCommon requirements spec 'Print Job Management' shall apply. The requirements specify the settings that can be changed in each PackML state. This can lead to changes in settings being rejected. If a setting change is rejected the command will fail.

Command	Field	Field Length	Notes
Message Identifier	~SC		
Message Body	Setting Name	Variable	As defined in printer settings file
	Setting Value	Variable	

Example

~SCdarkness|90|

The new settings value (if valid) will take effect as soon as possible before the next print. It will not change settings during a print.

5.17 Setting Request

Set to NGE device to request a setting value.

Request	Field	Field Length	Notes
Message Identifier	~SR		
Message Body	Setting Name	Variable	As defined in printer settings file

Example

~SRdarkness|

5.18 Setting Value

Sent by NGE device in response to a Request Settings message.

Request	Field	Field Length	Notes
Message Identifier	~SV		
Message Body	Status	1 character	Optional
	Setting Name	Variable	As defined in printer settings file
	Setting Value	Variable	As defined in printer settings file

Example

~SVdarkness|90|

~SV0|darkness|90| (if 'Status' field enabled.

5.19 Print Request

Sent to NGE device to request a print action

Command	Field	Field Length	Notes
Message Identifier	~PG		
Message Body	Line Reference	Variable	Blank if single head
	Action	1 character	0 – Print 1 – Print & Apply 2 – Apply only
	Reply Timing	1 character	0 – Reply immediately 1 – Reply when action started 2 – Reply when action complete

Example

~PG|0|0|

Command Reply:

~PG0|

5.20 Print Status Request

Sent to NGE device to determine if device is ready to print

Request	Field	Field Length	Notes
Message Identifier	~PS		
Message Body	Line Reference	Variable	Blank if single head
	Reply Timing	1 character	0 – Reply immediately 1 – Reply when ready to print

Example

~PS|0|

Note: Ready to print is defined as device in 'producing' state and any imaging is complete.

If the NG Device is not in the 'Producing' state the request will get an immediate response since the controlling application will never otherwise get a reply.

5.21 Print Status Response

Sent by NGE device to report if device head is ready to print

Response	Field	Field Length	Notes
Message Identifier	~PR		
Message Body	Status	1 character	Optional
	Print Status	1 character	0 – Ready to print 1 – Unable to print, incorrect state 2 – Unable to print, printing 3 – Unable to print, fault

Example

~PR0|

~PR0|0| (if 'Status' field enabled)

5.22 State Change

Sent to NGE device to request a state change

Command	Field	Field Length	Notes
Message Identifier	~ST		
Message Body	Line Reference	Variable	Blank if single head
	New State	2 character	See section 0.

Example

~ST|04|

The NGE device will transition to the new state (if permitted) using the PackML state model. The intervening states will not be reported via this link. The success or failure of this command can be determined from the device status.

Note – for SmartDate: only the READY, PRODUCING and HELD states can be targeted by this operation.

5.23 Virtual Output Request

Sent to NGE device to request the state of the virtual Outputs

Command	Field	Field Length	Notes
Message Identifier	~OR		
Message Body	None		

Example

~OR

5.24 Virtual Outputs

Sent by NGE device to report the state of the virtual Outputs

Command	Field	Field Length	Notes
Message Identifier	~OV		
Message Body	Status	1 character	Optional
	Virtual Outputs	10 characters	10 Virtual Outputs arranged as binary. Virtual output 1 sent first

Example

~OV0000000001| (Shows output 10 active, 1-9 inactive)
~OV0|0000000001| (if 'Status' field enabled)

5.25 Set Virtual Input

Sent to NGE device to set the virtual input states used by flexible mapping. NGPCL supports eight virtual inputs.

Command	Field	Field Length	Notes
Message Identifier	~SI		
Message Body	New Control	8 characters	8 virtual inputs Binary format. Virtual input 1 sent first 0 – Clear virtual input, 1 – Set virtual input, X – leave unchanged

Example

~SI0000001X|

This command clears virtual inputs 1 – 6, sets virtual input 7 and leaves virtual input 8 unchanged.

5.26 Request Clock

Sent to NGE device to request current clock values

Request	Field	Field Length	Notes
Message Identifier	~RC		
Message Body	None		

Example

~RC

5.27 Current Clock

Sent by NGE device in response to a Request Clock

Response	Field	Field Length	Notes
Message Identifier	~CC		
Message Body	Status	1 character	Optional
	Clock value	19 characters	hh:mm:ss dd/mm/yyyy

Example

~CC10:25:40 04/12/2003|

~CC0|10:25:40 04/12/2003| (if 'Status' field enabled)

5.28 Clock Set

Sent to NGE device to adjust Clock

Command	Field	Field Length	Notes
Message Identifier	~CS		

Message Body	Clock value	19 characters	hh:mm:ss dd/mm/yyyy
--------------	-------------	---------------	---------------------

Example

~CS10:25:40 04/12/2003|

5.29 Version Request

Sent to NGE device to request NGE Device Firmware version

Request	Field	Field Length	Notes
Message Identifier	~VR		
Message Body	None		

Example

~VR

5.30 Version Response

Sent by NGE device in response to a Request Version

Response	Field	Field Length	Notes
Message Identifier	~VV		
Message Body	Status	1 character	Optional
	Program Major Version	3 characters	
	Program Minor Version	3 characters	
	Program Release	3 characters	

The adopter may define and add extra version information to this message.

Example:

~VV001|001|001|

~VV0|001|001|001| (if 'Status' field enabled)

5.31 Allocation Clear

Sent to NGE device to request the clearance of an allocation

Command	Field	Field Length	Notes
Message Identifier	~AC		
Message Body	Job Name	Variable	

The Job Name field may be left blank when sent to NG devices that only support a single job.

Example:

~AC|

Note: If the user does not want the NG device to start printing immediately upon receipt of this command they should move the device out of the 'Producing State' using the 'State Change' Command

5.32 Protocol Version Request

Sent to the NGE device to request the version of NGPCL supported. Request added to support requirements for Parent/Child controller connection.

Request	Field	Field Length	Notes
Message Identifier	~PV		
Message Body	None		

5.33 Protocol Version Response

Sent by NGE device to indicate the version of NGPCL supported.

Request	Field	Field Length	Notes
Message Identifier	~VP		
Message Body	Status	1 character	Optional
	Version String	Variable	

Example:

Request: ~PV|

Response: ~VP2.0|

~VP0|2.0| (with optional status field)

5.34 File Transfer Command (5800 only)

Sent to the NGE device. Indicates that impending file transfer will occur. Specifies the name of the file being transferred as well as the number of data packets that will need to be received and processed.

Optionally the sender can send the mod1000 checksum of the file contents, to be verified by the receiver once the final data packet is received. Multiple concurrent file transfers are not supported over one NGPCL link.

Request	Field	Field Length	Notes
Message Identifier	~FT		
Message Body	File name	variable	Includes extension
	Packets	Variable	The number of File Data packets to send complete base64 encoded file.
	File Checksum	3 characters	A mod1000 checksum of the contents of the file being transferred. Optional. Not implemented.

Sent to the NGE device. A file transfer will be broken up into multiple smaller packets, containing at most 1024 bytes of **raw** file data. The file data will be base64 encoded. Optionally each packet can be numbered for added data integrity.

Request	Field	Field Length	Notes
Message Identifier	~FD		
Message Body	Data Length	variable	Length of base64 encoded data in characters
	Data	Variable	File data base64 encoded
	Packet Number	variable	Index used to ensure the order of the packets. Optional. Not Implemented.

Example without packet numbers:

Request: ~FTmyTestFile.bmp|1|

Response: ~FT0|

Request: ~FD1024|<FileData>|

Response: ~FD0|

Example with packet numbers:

5.35 Job Preview Request (5800 only)

Sent to the NGE device to request a preview of the currently selected job.

Request	Field	Field Length	Notes
Message Identifier	~JP		
Message Body	None		

5.36 Job Preview Response

Sent by the NGE device in response to a preview request of the currently selected job.

Request	Field	Field Length	Notes
Message Identifier	~PJ		
Message Body	Success Code	1 Character	
	Width	Variable	Width of the preview bitmap in pixels
	Height	Variable	Height of the preview bitmap in pixels
	Preview Data	Variable	Preview data base64 encoded

5.37 User Request

Sent to NGE device to request 'User Data'.

Request	Field	Field Length	Notes
Message Identifier	~UR		
Message Body	None		

5.38 User Data

Sent by NGE device in response to 'User Request'.

Request	Field	Field Length	Notes
Message Identifier	~UD		
Message Body	Status	1 character	Optional
	Defined by user	Variable	See adopter's manual

This message provides a mechanism for the adopter to return data that is specific to the NextGen adopter. The adopter must define the format of the data. E.g. SmartDate5 radial ribbon save data.

5.39 User Command

Sent to NGE device to perform a function particular to the adopter software.

Request	Field	Field Length	Notes
Message Identifier	~UC		
Message Body	Defined by user	Variable	See adopter's manual or Adopter specific commands in this document

This message provides a mechanism to send a command that is specific to the adopter. The adopter must define the format of the message body. E.g. SmartDate5 radial ribbon save command.

6 PackML Codes

The PackML states are represented using the codes defined in the PackML Tag Naming document (V1.0) produced by the OMAC packaging workgroup.

PackML State	Code used in NGPCL
Undefined	00
Off	01
Stopped	02
Starting	03
Ready	04
Standby	05
Producing	06
Stopping	07
Aborting	08
Aborted	09
Holding	10
Held	11

The PackML modes are represented using the codes defined in the PackML Tag Naming document produced by the OMAC packaging workgroup.

PackML Mode	Code used in NGPCL
Undefined	0
Automatic	1
Semi-Automatic	2
Manual	3
Idle	4

7 Worked Checkfield Example

This example shows the way a checkfield would be calculated in practise.

Refer back to section **Error! Reference source not found.** where message structure is defined.

For the purpose of this example take an example of the Job Select command.

```
~JS0|Job1|1| Field1|Field1Value|Field2|Field2Value|
```

Job Select is taken as the example here since it includes a variable number of arguments and thus the example illustrates the correct message formatting.

The Checkfield is computed on the message before it is inserted into the packet.

Each character is converted to its corresponding decimal value. This is a standard program statement in most programming languages, for example in Visual Basic statement *Asc("A")* returns the decimal value 65.

Working through the message '~' converts to 126, 'J' converts to 74 and so on the end of the string.

Summing these values gets the result 4760. Taking Mod 1000 of this value gives 760. Thus the resulting packet is:

```
<STX>~JS0|Job1|1| Field1|Field1Value|Field2|Field2Value||760<ETX>
```

Where <STX> denotes the single Start of Transmission character and <ETX> the End of Transmission character.

Note that mechanism is the same whether the character is normal ASCII or Unicode

8 Summary of Message Identifiers

Sorted into alphabetic order.

Message Identifier	Function	Type
~AC	Allocation Clear	Command
~CC	Current Clock Value	Response
~CR	Counts Request	Request
~CS	Clock Set	Command
~CV	Counts Values	Response
~DC	Clear to Send Data Request	Request
~DR	Device Status Request	Request
~DS	Device Status	Response
~DV	Clear to Send Data Response	Response
~FC	Field Contents	Response
~FL	Logged Fields Request	Request
~FR	Field Request	Request
~FV	Logged Field Contents	Response
~JN	Job Name	Response
~JR	Job Request	Request
~JS	Job Select	Command
~JU	Job Update	Command
~NK	NAK	Response
~OR	Virtual Output Request	Request
~OV	Virtual Outputs	Response
~PG	Print Go	Command
~PR	Print Status Response	Response
~PS	Print Status Request	Request
~PV	Protocol Version Request	Request
~RC	Request Clock	Request
~SC	Setting Change	Command
~SI	Set Virtual Input	Command
~SR	Setting Request	Request
~ST	State Change	Command
~SV	Setting Value	Response
~UC	User Command	Command
~UD	User Data	Response

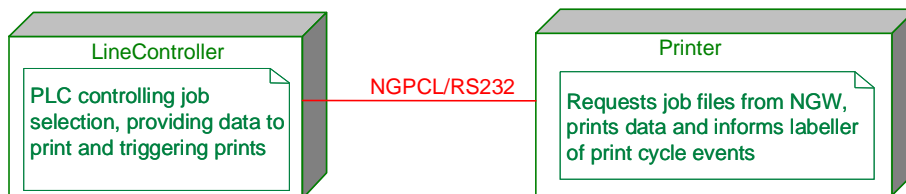
~UR	User Request	Request
~VP	Protocol Version Response	Response
~VR	Request Version	Request
~VV	Device Version	Response

9 NGPCL System Integration Scenarios

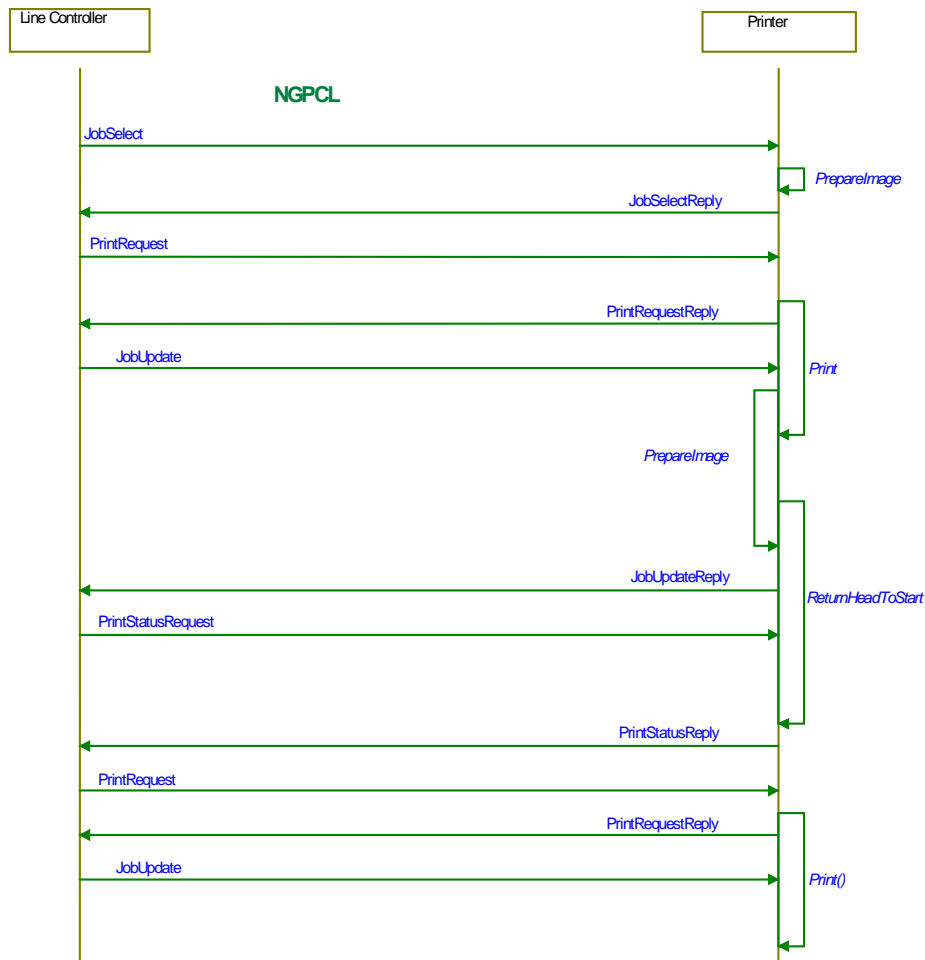
The following two integration scenarios show the communications between a NextGen printer and other deployed components. The aim is to show how race conditions are avoided and maximum machine efficiency is obtained via command sequences issued by a line controller using NGPCL.

9.1 Full NGPCL Control

Within this scenario, the line controller has full control over the printer. The line controller is responsible for initiating job selection, providing field data on a per-print basis and initiating these prints.



The sequence below shows the NGPCL communication between the line controller and printer to select a job and initiate 2 prints.

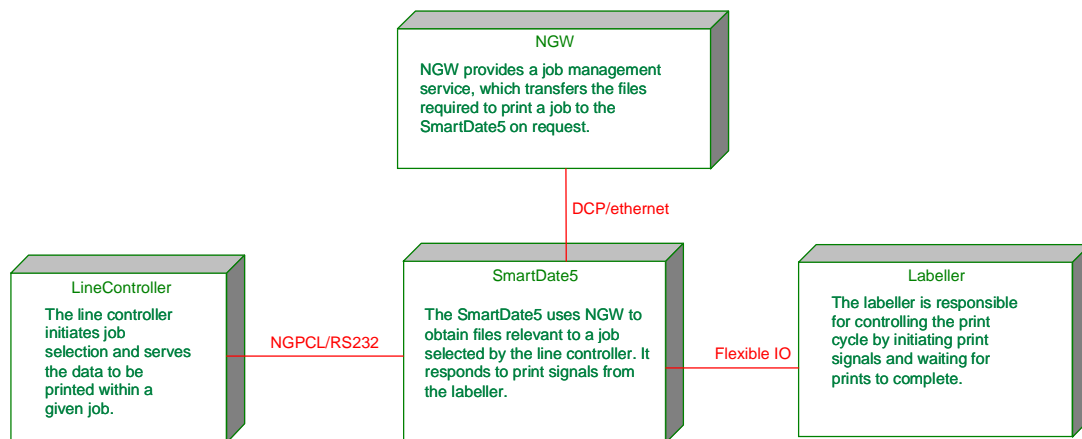


Within the above sequence,

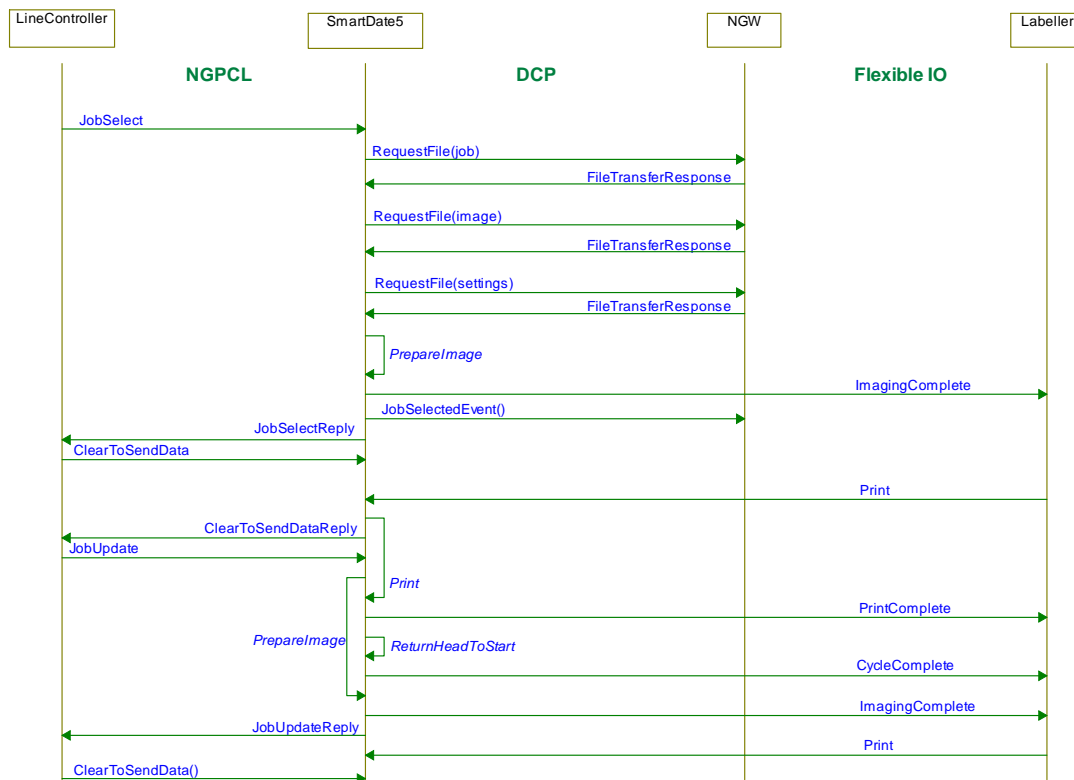
- *JobSelect* and *JobUpdate* commands are invoked with the reply timing *Reply when job imaged*. No NGPCL communication therefore occurs until the internal action *PrepareImage* has completed.
- The *PrintStatusRequest* command is invoked with the reply timing *Reply when ready to print*. NGPCL communication thus blocks until the internal action *ReturnHeadToStart* has completed.
- The *PrintRequest* command is invoked with the reply timing *Reply when action started*. This allows *JobUpdate* commands to initiate imaging while printing.

9.2 NGPCL Line Control with Flexible IO Print-Go

This deployment scenario involves a line controller invoking jobs on the printer and supplying field data on a per-print basis. The labeller is responsible for triggering prints. The printer (for example, a SmartDate5) is configured to use NGW as its database.



The sequence below shows the communication between the line controller, printer, labeller and NGW to select a job and initiate 2 prints



Within the above sequence

- *JobSelect* and *JobUpdate* commands are invoked with the reply timing *Reply when job imaged*. No NGPCL communication therefore occurs until the internal action *PrepareImage* has completed.
- The *ClearToSendData* command is invoked in order to determine when *UpdateJob* can be invoked.
- *ClearToSendDataReply* is sent in response to *ClearToSendData* when printing the current image buffer begins. This allows imaging while printing. NGPCL communication is blocked between sending *ClearToSendData* and receipt of a print signal (via flexible IO).

10 Check Weigh Applications using NGPCL

Within a checkweigh applications the content of particular fields within the printed image will be updated between each print. This means the image used must be designed to contain fields which can be dynamically updated using NGPCL.

In order to support check-weigh applications, the image designer must select the **user-input** data source for all fields requiring dynamic update. This supports updating the printed data to a new Unicode text string while printing in the *Producing* mode via communication with an external application.

The strings served by the application can be of any form (e.g. numeric, alphabet, alphanumeric, empty). The image designer can, however, define constraints on the set of acceptable strings (e.g. a 4 digit number). When the image update takes place, data is validated against these constraints. If it fails, then this failure is reported to the user.

The image designer must also ensure that all fields requiring dynamic update as part of the application are given a unique name. This name is used to identify which fields require updating as part of the update message.

10.1 Printer Settings.

In order to receive messages via NGPCL, including job update messages, the printer must be configured appropriately. The following settings must be configured to the following values

Serial Port1 Function – NGPCL (RS232)

Serial Port1 Baud Rate – 57600 (*or baud rate of controlling application*)

Serial Port1 CharSet – Ascii (*or Unicode if controlling application uses Unicode*).

In addition, in order to trigger prints using NGPCL, the SD5 must be configured to use an external print trigger.

10.2NGPCL Image While Printing Print Cycle

The NextGen PCL command set and protocol structure is fully documented in NextGen PCL product functional specification. This section details how commands within this command set should be sequenced to run a check-weigh application to obtain the maximum pack-rate. It is assumed that the application is in full control of the print cycle. New field data is submitted and prints are initiated using NGPCL; print trigger signals are received via an alternative external source.

The check-weigh print cycle is maximally efficient if the printer is re-imaging the next print with new data while printing while also printing the current image. This means submitting data to be printed immediately after a print has started, rather than waiting for the print to complete. Ensuring this "image while printing" cycle is robust (that no data is lost or images printed twice) also entails ensuring that both the imaging and printing process has completed before triggering the next print. NGPCL provides the following commands to support this.

Job Update. The job update command is used to submit new field data to print. It takes a list of {field name, data value} pairs as its arguments. In addition, a reply timing argument is used to state whether the response should be sent immediately, or after the imaging process has completed. When the reply timing is *reply immediately*, the response to this command indicates whether all fields to be updated could be located in the image. When the reply timing is *reply when job imaged*, the response to this command indicates whether all fields to be updated were successfully updated.

In this context, we cannot trigger a print until a fresh image has been prepared, so the *reply when job imaged* reply timing is used. A job update command may, however, complete before the printer has finished printing the previous image. It is therefore not safe to trigger a print immediately after a reply to job update command is received.

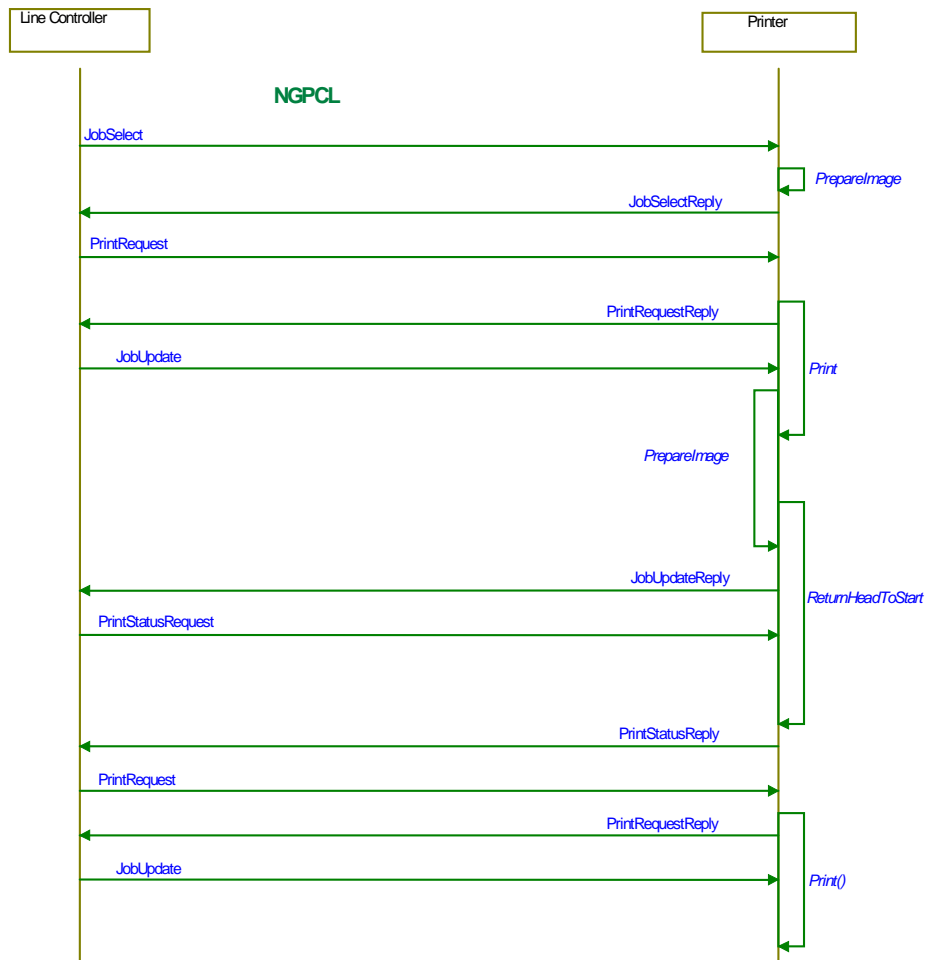
Prin Status Request. In order to ensure the NGE Device is ready to print, the PrintStatusRequest command can be used. The response to this command indicates whether the system is currently printing, in a fault state or ready to action a fresh print trigger. A reply timing argument is used to specify whether the response is *reply immediately*, or *reply when ready to print*.

In this context, we want the check-weigh application to wait until the previous print has completed before triggering the next print. The *reply when ready to print* reply timing is therefore used.

Print Request. The print request command is used to trigger a print. A reply timing argument is used to specify whether the response is *reply immediately*, *reply when print started* or *reply when print complete*.

In this context, we do not want to wait until the print has completed as this would unnecessarily delay re-imaging with fresh data. However, we do not want to submit fresh data and invoke the re-imaging process immediately, as we may overwrite the previous image before before it is printed. The *reply when print started* reply timing is therefore used. This guarantees the current image buffer will not be refreshed before it is printed.

The diagram below shows the above messages being sequenced to run a checkweigh application supporting re-imaging while printing. In addition, it shows the JobSelect command being used to select a job.



10.3NGPCL *Image While Printing* Print Cycle Commands Example

The following provides an example of the NGPCL commands submitted to the NGE Device to run the above print cycle.

STX ~JU1||0|User Input Barcode|0123456789128|Weight|12.50g|Price|£30.50| ETX

STX ~PS|1| ETX

STX ~PG|0|1| ETX

10.4NextGen PCL / Legacy PCL Compatibility.

NextGen PCL is designed to be backwards compatible with the legacy PCL supported by the SD3 and Cimjet (ASCII Comms). While NGPCL packets are intended to start with STX and end with ETX, the legacy PCL packet delimiters ^A and ^Z can be used in their place. Likewise the NextGen PCL message start character (~) can be replaced with the legacy PCL ^ character.

There are, however, some differences between the commands intended to be used to submit fresh data between prints.

The legacy *Update Variable Fields* command takes a list of {field number, data-value } pairs. In contrast, the NGPCL *Job Update* command requires a sequence of { field name, field value } pairs.

In order to maintain backwards compatibility, NextGen PCL supports the legacy UpdateVariable Fields command in the following way: field numbers are determined by the position of the field within the image file.

The consequence of using this legacy command to update field data is a slightly lower pack rate. It is therefore advisable to use the new *Job Update* command.

11 Adopter specific commands

11.15600/5800 specific commands

11.1.1 Counts Values

Sent by NGE device in response to a 'Request Counts' message

Response	Field	Field Length	Notes
Message Identifier	~CV		
Message Body	Count Type	5 Characters	A code defining the count type
	Count Value	9 Characters	

Count Type and Value will be repeated within the message body.

Example

~CVTOTAL|000000000|BATCH|000000000|

The number of counts reported will be defined by the adopter project. The NextGen core defines the following counts that shall always be sent (in this order first):

Count	Count type code
Total Print Count	TOTAL
Batch Print Count	BATCH

Additionally the following counts will be sent by a 5600/5800 device in any order (after the previously listed counts):

Count	Count type code
Total Fail Count	TFAIL
Batch Fail Count	BFAIL

11.1.2 Remote Purge

Sent to NGE Device to request a remote purge. It is implemented as a [User Command](#).

Response	Field	Field Length	Notes
Message Identifier	~UC		
Message Body	RP	2 Characters	Specifies Remote Purge
	Printhead	3 Characters	Printhead to purge; "PH1" or "PH2"

Example:

~UCRP|PH2|

11.1.3 Clear Print Queue

Sent to NGE Device to request that it clears out the print queue. It is implemented as a [User Command](#).

Response	Field	Field Length	Notes
Message Identifier	~UC		
Message Body	CPQ	3 Characters	Specifies Clear Print Queue

Example:

~UCCPQ|