

Application Notes Affected: AN2005-005 version 1.1

AN2005-006 version 1.1

AN2007-001 version 1.1

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1 Overview

This technical note is to clarify and correct the application notes following the completion of interoperability testing. Topics arising from the testing are:

1. Clarify that local changes to applications should set the HCDS “configuration changed” indication
2. Clarify that applications must have a version
3. A number of items need to be added to the Device Profile to assist the MS to inter-operate with the FDs and to correct the display generated by the XSLT.
4. AN2007-001 section 4.7.2 states that the device profile defines whether or not configuration persists across a cold restart, however the WITS DP does not define this! It also states that the MS does not need to know this, so rather than add it to the DP we should remove the words from 4.7.2 that says it is in the DP.
5. AN2007-001 section 4.7.2 states that a cold restart on a FD which preserves configuration across a restart is “identical” to a warm restart. However, it also states that a cold restart is equivalent to a power cycle. These two statements are contradictory, for example a TCP/IP connection or PSTN/GSM modem connection cannot persist across a power cycle but will persist across a warm restart.
6. When an action inhibit is applied/removed to an individual point whilst all points are already inhibited, should the FD still perform the highest configured action for the individual point even though that action may be inhibited by the ‘all points’ inhibit? AN2005-005 section 2.8 doesn’t address this scenario; it just says perform highest **configured** action for the point. This is similar to the scenario with point & device on/off scan.
7. If the source point of a derived point (runtime, integral etc.) is off-scan (and therefore ONLINE flag is clear) should the derived point also have its ONLINE flag clear to indicate that the source isn’t valid. It has been agreed that the MS should take derived points off-scan at the same time, either automatically or warn the user to do so.
8. State runtime needs a note added to state that the derived counter value may not be continuously updated by the FD. It may only be updated by the FD when the source point changes state of quality flags.
9. When a virtual point’s purpose is changed to/from a derived point or between different types of derived point then the point’s value/state should be ‘cleared’ and the RESTART flag set, otherwise the point will inherit the value from the previous purpose.
10. The current release of the notes erroneously state that FC26 – close file, FC28 – get file information, and FC 30 – abort file are mandatory critical functions. They should be shown as optional.
11. FC0 (confirmation from MS to FD) cannot be defined as critical for all comms scenarios. It needs to be critical where there is a possibility of loss of data (reporting events, reading file data, etc) but in other cases it cannot be deemed critical (for example confirming an initial unsolicited NULL response). WITS-DNP3 version 1.1 will define FC0 as optional. Future versions of WITS-DNP3 will define explicitly those scenarios where FC0 will be critical.
12. Add a note to section 3.1.1 of AN2007-001 to state that underscore and period are not valid characters in the “version” component of the BCF filename string.
13. Activating a new BCF may be followed by a cold or warm restart, but specification currently says it must be a warm restart. Add the option for a cold restart.
14. When validating analogue/counter limits (downloading IC records 1003 & 1004) it is not valid for two adjacent limits (with the same direction) to have the same value.
15. The AN does not say whether the FD should apply hysteresis/persistence when applying or releasing an override.

16. The AN does not state when the resulting “actions” should be applied when the FD is processing an override request (applying or removing).
17. The AN does not clearly define how counter overrides should be processed (especially when the override value is less than the current value).
18. The callback data set needs clarification about the optional use of the “port” component of the “network information” field.
19. The callback data set needs clarification that the MS can terminate the call irrespective of the FD saying it is OK (via HCDS bit 7).
20. Modify the “notes” for the Apps Manager data set, to re-order comments about applications not existing and problems with MS requests so that the intent is unambiguous.

2 Changes to the Application Notes

Changes are to be made to the applications notes as shown in this section.

NB. In the following sections, text that is shown in **red** represents words to be removed from the application notes and text in **blue** represents words to be inserted into the notes.

2.1 Applications

To clarify:

- local changes to applications should set the HCDS “configuration changed” indication
- applications must have a version

2.1.1 AN2005-005 Section 2.5.9 (bullet list)

Add to the bullet list as shown:

- When the Configuration Application downloads a new bulk configuration file.
- **When an Application is changed locally**
- When the local display on the Field Device or a diagnostic terminal (VT Terminal, Telnet etc.) connected to the Field Device is used to put a point or the device off scan, change a limit or persistence, etc.

2.1.2 AN2007-001 Section 3.1.1 (Application Program Files bullet)

Add a second note at the end of the section shown:

Notes:

- Internally each application program file may consist of one or more separate files, packaged in a vendor specific way, and unpacked on the Field Device in a vendor specific way. From the standards viewpoint each program is only ever a single file.
- **Each application known to the Field Device *must* be configured with a version string. If applications are configured locally then the tool used for configuring the applications, or the Field Device itself, must provide a version string for each application. Applications loaded from the Master Station carry the application version within the downloaded filename string.**

2.2 Device profile

To add to or correct the Device Profile:

- The max number of vectors in a profile is 1440 (and not 1439 as currently used)
- The revision history doesn't exist in the XML schema (just the word version) so remove this from the XSLT transformation file.
- A new entry to describe if the FD does a cold restart or warm restart following the activation of a new bulk configuration
- A new entry to describe the resolution of limit "persistence"
- Details of periodic logging rates and offsets
- Details of Point Events data sets

2.2.1 Device Profile – section 1.7.3

Correct as shown:

<p>1.7.3 Maximum number of vectors per limit profile: profile: <i>Range 0 to 143940 (one per minute). Enter zero if profiles are not supported.</i></p>

2.2.2 Device Profile – XSLT

Remove the section of code that displays the DP revision history.

2.2.3 Device Profile – new section 1.13.6

Add new section as shown:

<p>1.13.6 Activate bulk configuration: <i>A device may either cold restart or warm restart when a new bulk configuration file is activated</i></p>	<p><input type="checkbox"/> Cold Restart <input type="checkbox"/> Warm Restart</p>
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to the word version and all XML components.

2.2.4 Device Profile – new section 1.4.7

Add new section as shown:

<p>1.4.7 Persistence resolution:</p>	<p>10 ms</p>
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to the word version and all XML components. Renumber all following sections of part 1.4.

2.2.5 Device Profile – new section 1.6.5

Add new section as shown:

1.6.5 Persistence resolution:	10 ms
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to the word version and all XML components.

2.2.6 Device Profile – new sections 1.11.6 and 1.11.7

Add new sections as shown:

1.11.6 Supported periodic logging rates (minutes):	<input type="checkbox"/> Fixed at ____ <input type="checkbox"/> Configurable, range _ to _ <input type="checkbox"/> Configurable, selectable from ____, ____, ____ <input type="checkbox"/> Configurable, other, describe _____
1.11.7 Supported periodic logging offsets (seconds):	<input type="checkbox"/> Fixed at ____ <input type="checkbox"/> Configurable, range _ to _ <input type="checkbox"/> Configurable, selectable from ____, ____, ____ <input type="checkbox"/> Configurable, other, describe _____

to the word version and all XML components.

2.2.7 Device Profile – new sections 1.14

Add new sections as shown:

1.14.1 Supports generating point data set events (action 2):	<input type="checkbox"/> Yes <input type="checkbox"/> No
1.14.2 Supports generating point data set events and triggering connection request (action 3):	<input type="checkbox"/> Yes <input type="checkbox"/> No

to the word version and all XML components.

2.2.8 Device Profile – version

Update the Device Profile version (to 1.3) in the word version and all XML components.

2.3 Cold and warm restart behaviour

2.3.1 AN2007-001 section 4.7.2

Remove statement that the Device Profile defines whether configuration is saved across a cold restart. Clarify statement about cold restart being identical to a warm restart because connection orientated communications sessions cannot be maintained across a power cycle but will be maintained across a warm restart.

Add note that secure authentication session keys do not persist over a restart, as shown:

- Cold Restart (function code 13)
 - This is the equivalent of a power cycle (see 4.7.3 below)
 - Signified to the Master Station in the IIN 1.7 “device restart” bit
 - The device configuration may or may not survive a cold restart. **The action of a particular device type is defined in the device profile.**
 - **If the configuration survives, the activity is identical to a Warm Restart,**
 - If the configuration does not survive, the Master Station is notified by the IIN 2.5 “Configuration Corrupt” bit, and acts accordingly to configure the Field Device

NOTE

- Any connection orientated communications sessions will be lost following a cold restart and need to be re-established.
- Secure Authentication session keys do not persist following either a cold restart or warm restart.

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2.4 Applying/Removing action inhibits and points on/off scan

2.4.1 AN2005-005 section 2.8 (last paragraph)

Clarify that when applying / removing an inhibit for an individual point the highest action for the point must be performed irrespective of the state of the “all points” inhibit. Modify the paragraph as shown:

When applying or removing an action inhibit for a point the highest action of all of the enabled limits (analogue or counter points) or all of the states (binary points) **and all** of the DNP3 object flags (all point types) must be performed by the Field Device immediately, **irrespective of the state of the “all points” inhibit**, to report the current state of the point. This includes when an action inhibit is applied or removed due to an ‘all points’ action inhibit and when an action inhibit is automatically removed by the Field Device when the time out expires.

2.4.2 AN2005-006 section 2.1.2.1 (end of section)

Add a new note that if the source point of a derived point (runtime, integral etc.) is off-scan (and therefore ONLINE flag is clear) the derived point should also have its ONLINE flag clear to indicate that the source isn't valid.

NOTE

- When a point is put off-scan, and there are virtual points being derived from this source point, the Master Station will either:
 - automatically put all related virtual points off scan, or
 - warn the user to manually put all related virtual points off scan

2.5 Changing the use of a virtual point

When a virtual point's purpose is changed to/from a derived point or between different types of derived point then the point's value/state should be 'cleared' and the RESTART flag set, otherwise the point will inherit the value from the previous purpose.

2.5.1 AN2005-006 section 2.1.2.9 (notes at end of section for ROC)

Add a new note to the end of list, as shown:

- When this IC record is processed by the Field Device it must determine if there is a change being made to the configuration of either of the virtual point indices (the virtual analogue input used for the rate of change value and the virtual binary input that may be used for the "no change" indication). For any change of the ROC index it should set the value of the virtual point to zero and set the virtual point's RESTART flag. For any change of the "no change indication" index it should set the value of the virtual point to one and set the virtual point's RESTART flag. This ensures that the value/state and flags set from any previous use of the points are not interpreted as pertaining to the rate of change value and "no change" indication.

2.5.2 AN2005-006 section 2.1.2.11 (notes at end of section for MIN)

Add a new note to the end of list, as shown:

- When this IC record is processed by the Field Device it must determine if there is a change being made to the configuration of the virtual point's index. For any change of index it should set the value of the virtual point to the current value of the source point and set the virtual point's RESTART flag. This ensures that the value and flags set from any previous use of the point are not interpreted as pertaining to the minimum value.

2.5.3 AN2005-006 section 2.1.2.12 (notes at end of section for MAX)

Add a new note to the end of list, as shown:

- When this IC record is processed by the Field Device it must determine if there is a change being made to the configuration of the virtual point's index. For any change of index it should set the value of the virtual point to the current value of the source point and set the virtual point's RESTART flag. This ensures that the value and flags set from any previous use of the point are not interpreted as pertaining to the maximum value.

2.5.4 AN2005-006 section 2.1.2.13 (notes at end of section for MEAN)

Add a new note to the end of list, as shown:

- When this IC record is processed by the Field Device it must determine if there is a change being made to the configuration of the virtual point's index. For any change of index it should set the value of the virtual point to the current value of the source point and set the virtual point's RESTART flag. This ensures that the value and flags set from any previous use of the point are not interpreted as pertaining to the mean value.

2.5.5 AN2005-006 section 2.1.2.14 (notes at end of section for integral)

Add a new note to the end of list, as shown:

- When this IC record is processed by the Field Device it must determine if there is a change being made to the configuration of the virtual point's index. For any change of index it should set the value of the virtual point to zero and set the virtual point's RESTART flag. This ensures that the value and flags set from any previous use of the point are not interpreted as pertaining to the integral value.

2.5.6 AN2005-006 section 2.1.2.15 (notes at end of section for state counter)

Add a new note to the end of list, as shown:

- When this IC record is processed by the Field Device it must determine if there is a change being made to the configuration of the virtual point's index. For any change of index it should set the value of the virtual point to zero and set the virtual point's RESTART flag. This ensures that the value and flags set from any previous use of the point are not interpreted as pertaining to the state counter value.

2.5.7 AN2005-006 section 2.1.2.16 (notes at end of section for state runtime)

Add new notes to the end of list, as shown:

- When this IC record is processed by the Field Device it must determine if there is a change being made to the configuration of the virtual point's index. For any change of index it should set the value of the virtual point to zero and set the virtual point's RESTART flag. This ensures that the value and flags set from any previous use of the point are not interpreted as pertaining to the state runtime value.
- The derived counter value might not be continuously updated by the Field Device. It might only be updated periodically (e.g. once per minute) or it might only be updated when the source point changes state or the source point quality flags change. Users should be aware that if the point is not continuously updated then any configured "periodic logging" and "limit" actions may not behave as expected.

2.6 Critical function codes

Some function codes have erroneously been defined as critical.

2.6.1 Appendix B, table 1-1 (table of critical functions)

Change the file handling entries as shown:

26	0x1A	Close File	MANDATORY OPTIONAL
27	0x1B	Delete File	MANDATORY
28	0x1C	Get File Information	MANDATORY OPTIONAL
29	0x1D	Authenticate File	MANDATORY
30	0x1E	Abort File	MANDATORY OPTIONAL

Change the MS confirmation entry and include the footnote as shown:

0	0x00	Confirm	MANDATORY OPTIONAL ¹
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2.6.2 AN2007-001, section 4.8

Add a new para (after para 6) as shown:

When a Field Device initiates a connection to a Master Station (e.g. an incoming PSTN call, or an inbound IP connection) then the Field Device must send an unsolicited response to the Master Station in order to identify itself. This unsolicited response may be either a NULL response or may contain pending events from its event queue.

If authentication is enabled then the Field Device must always initiate a connection with a NULL unsolicited message (rather than one that contains events). NULL unsolicited responses are not affected by the current enabled/disabled state of unsolicited reporting. Therefore if a Field Device (with authentication enabled) has unsolicited reporting currently disabled (for whatever reason) and initiates a new connection then it must send an initial NULL unsolicited response and (can) retry this NULL unsolicited (if not confirmed by the Master Station) but must not send any other unsolicited responses until unsolicited reporting is enabled.

The Master Station must be prepared to receive either a NULL response or a response containing events as the first application message received on the connection.

¹ Future versions of WITS-DNP3 will define that this function code be deemed as critical in certain scenarios to ensure that data cannot be lost because of a spoof Master Station intercepting the data and confirming the receipt.

2.7 BCF download, version string and activation

Add a note that applications may need to be downloaded by the Master Station when a new BCF is loaded, because the Field Device may not have retained any previously loaded applications.

Add a note to state that underscore and period are not valid characters in the “version” component of the BCF filename string

Activating a new BCF may be followed by a cold or warm restart, but specification currently says it must be a warm restart. Add the option for a cold restart

2.7.1 AN2007-001 – end of section 4.3.1

Add a note to the end of the section as shown:

NOTE

- When a BCF is downloaded to the Field Device (and successfully activated) it is expected that the Field Device will delete any previously configured application files. The Master Station will download any relevant applications with the new BCF.

2.7.2 AN2007-001 – end of section 3.1.1

Add a note to the end of the section as shown:

Note:

- Internally the BCF may consist of one or more separate files, packaged in a vendor specific way, and unpacked on the Field Device in a vendor specific way. From the standards viewpoint the BCF is only ever a single file.
- Characters “underscore” and “period” can only be used once in the filename string, delineating the version and extension components of the file name.

2.7.3 AN2007-001 – 8th para of section 4.3.2

Make corrections to allow a cold or warm restart, as shown:

The Field Device must either cold restart or warm restart after successfully activating a bulk configuration file and the new bulk configuration file must replace the entire existing configuration in the Field Device. The choice of cold restart or warm restart is defined in the Device Profile for the Field Device. The warm restart ensures that the Master Station reads the object group 0 attributes (which may have changed), and that events are generated to report the initial state of each application program and each point.

2.7.4 AN2007-001 –section 4.7.2

Make corrections as shown:

- Warm Restart (function code 14)
 - Typically May be triggered by a new BCF
 - Typically a protocol stack restart
 - No loss of configuration

- Transparent to the Master Station other than being signified by the IIN 1.7 “device restart” bit
- Cold Restart (function code 13)
 - May be triggered by a new BCF
 - This is the equivalent of a power cycle (see **Error! Reference source not found.** below)
 - Signified to the Master Station in the IIN 1.7 “device restart” bit
 - The device configuration may or may not survive a cold restart. The action of a particular device type is defined in the device profile.
 - If the configuration survives, the activity is identical to a Warm Restart
 - If the configuration does not survive, the Master Station is notified by the IIN 2.5 “Configuration Corrupt” bit, and acts accordingly to configure the Field Device

2.8 Validating limit values

2.8.1 AN2005-006 – section 2.1.2.4 (limit value element)

Change the para to reject limits with the same value, as shown:

Limit Value (Element 7)

The limit value defines the threshold for this limit. The limit value is in engineering units, and the Field Device must store it in engineer units (not just the equivalent raw value), so that it is not affected by any subsequent change to the scaling of the point (see section **Error! Reference source not found.**). **The Field Device will reject any configuration that has the same Limit Value on adjacent Point Limit Indices by reporting error code 25 in the log file.**

2.8.2 AN2005-006 – section 2.1.2.5 (limit value element)

Change the para to reject limits with the same value, as shown:

Limit Value (Element 6)

The limit value defines the threshold for this limit. **The Field Device will reject any configuration that has the same Limit Value on adjacent Point Limit Indices by reporting error code 25 in the log file.**

2.8.3 AN2005-006 – section 2.2 (table 2-21)

Expand the details of error 25, as shown:

25	1003, 1004	Invalid limit value (e.g. a high limit is less than a low limit, adjacent limits have the same value).
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2.9 Applying/Removing override values

2.9.1 AN2005-006 – section 2.1.2.2 (end of section)

Add notes about processing overrides, as shown:

NOTE

- When an override is removed from an analogue input point any configured hysteresis or persistence should be applied if the point may subsequently move from one limit state to another (including the normal state). Similarly, hysteresis and persistence should be applied when overriding an analogue input point. Similarly, when applying or removing overrides with binary input points any configured persistence should be applied.
- The “action” that may be taken as a result of applying an override should be performed at the time that the Field Device is processing the IC record. The “action” that may be taken as a result of removing an override from an input point should be performed when the point is next scanned.
- When an override is applied to a counter point (or removed) the point is not assumed to have monotonically increased. Limit processing is applied to the change in the same way as for other point types i.e. assuming the point value has moved directly from its previous value to the override value.

2.10 Callback Data Set

2.10.1 AN2005-005 – section 2.6 (numbered list near end of the section)

Modify the para, as shown:

3. When the communications session is established on this port the Callback Data Set is read back as a static instance with the elements reflecting the settings entered in the callback request. The communications session is terminated when the Master Station requires *irrespective of the Field Device setting of “close comms link” (bit 7) of the Health Check Data Set.*

2.10.2 AN2005-005 – section 2.6 (immediately following the table defining the elements)

Add a note as shown:

NOTE

- The information returned in the 8th element of the static instance of the data set may not be exactly as received by the Field Device in the request from the Master Station, because the port number is optional. The Master Station should parse the response noting that the port number may or may not be present in the data set response. All other components of this 8th element must appear in the static instance of the data set **exactly** as received in the Master Station request.

2.11 Application Manager Data Set

Modify the “notes” for the Apps Manager data set, to re-order comments about applications not existing and problems with MS requests so that the intent is unambiguous

2.11.1 AN2005-005 – section 2.7 (notes at end of the section)

Modify the notes, as shown:

- The Master Station may write an instance of this data set to the Field Device to command the application to a specified state (as requested in element 10). In this case the write request from the Master Station should set elements 7 and 9 to zero and elements 6 and 8 to a zero length.

If an application does not exist at an index for which an action has been requested then the Field Device must issue a dataset event with just bit 4 of element 7 set to 1

If the Field Device detects a other problems with the content of the data set, such as an invalid control action or an invalid index, then it must set the IIN2.2 [PARAMETER_ERROR] bit in the response, to indicate that the action could not be performed. If the action is valid but cannot be implemented (such as starting an already running application) then the Field Device will return an Applications Manager Data Set with element 10 set to the action that was sent.

- If an application does not exist at an index for which an action has been requested then the Field Device will issue a dataset event with just bit 4 of element 7 set to 1.
- At any point in time the Master Station may request information about an application. To do this the Master Station writes an instance of the data set to the Field Device to command the application to return an instance of the data set showing the current application’s information. In this case the write request from the Master Station should set elements 7 and 9 to zero and set element 10 to a value of 6. Elements 6 and 8 should be set to a zero length. A device must respond to the write request with a null response and then generate a data set event to report the current information known about the requested application.