# Technical Information

TI 04L51B01-05EN

# Applying Yokogawa Recorders and Controllers to Heat Treatment Applications in the Aerospace and Automotive Industries

SMARTDAC+

DXAdvanced R4

UTAdvanced

The contents of this Technical Information are subject to change without notice.

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# Contents

# 1. Scope

(1) This document describes how the DXAdvanced, the SMARTDAC+ and the UTAdvanced of Yokogawa can fulfill the requirements from AMS 2750E and AS7102.
(2) This document refers to the above regulations. The copyright of each regulation belongs to its owner. If the quoted passage is different from the original documentation, the original documents prevail at all times.

# 2. What are DXAdvanced, SMARTDAC+ and UTAdvanced?

## 2-1 DXAdvanced: DX1000 & DX2000

(1) DXAdvanced is a paperless recorder; maximum number of directly connected universal measurement inputs is 48.

## 2-2 SMARTDAC+: GX10, GX20, GP10 & GP20

(1) The SMARTDAC+ is a paperless recorder with multi-touch display; maximum number of directly connected universal measurement inputs is 100.

## 2-3 DAQStandard for DXAdvanced

(1) DAQStandard is PC based software used for hardware configuration (Online- and Offline-), and historical data analysis and playback.
(2) Users can modify and/or upload and download configuration settings of the DXAdvanced.

## 2-4 Webserver and Hardware Configurator for SMARTDAC+

(1) The Webserver consist of a realtime monitor function and an on-line configurator.
(2) The Hardware Configurator is PC based software used for off-line hardware configuration.

## 2-5 Data Viewer software

(1) Users can playback the measurement data using the historical viewer in both trend-graph and digital format. Log information (Alarm log, operation log, …) can be displayed as well. All necessary information can be printed out using standard printers. Data conversion to major spreadsheet formats is also supported.

## 2-6 UTAdvanced: UT52A, UT55A & UP55A

(1) The UTAdvanced is a digital indicating PID controller with ladder sequence control; UT55A and UP55A have 1/4 DIN external structure and UT52A has 1/8 DIN external structure. Also UP55A is embedded with program pattern control.

# 3. Detail Description of DXAdvanced/ SMARTDAC+ and UTAdvanced – Operation Securities

## 3-1 Briefing

(1) AMS2750 requires that access to systems that are used to create, modify, maintain, or retrieve electronic records must be limited to authorized individuals.
(2) Additionally, authority checks are required to assure that authorized individuals accessing the systems are able to perform only tasks for which they have the appropriate level of access and for which they have been properly trained.
(3) DXAdvanced and SMARTDAC+ have a) Log-in security and b) key-lock function as standard.
(4) UTAdvanced has key-lock function and password control for configuration parameters as standard.

## 3-2 Log-in Security – DXAdvanced and SMARTDAC+

(1) Both can be configured to utilize a combination of user name, and password to limit system access to authorized users. Each user name must be unique. Permissions can be further defined to provide a variety of access levels ranging from view-only access to full administrative and remote communication and configuration rights. DXAdvanced allows the configuration of a maximum of five (5) administrators and up to thirty (30) users. SMARTDAC+ allows the configuration of a maximum of fifty (50) administrators and users in total. Individual users cannot modify their own access levels.
(2) Limiting system access to authorized users and controlling individual levels of access provides effective security for the use of the instrument.

## 3-3 Access Security – DXAdvanced, SMARTDAC+ and UTAdvanced

(1) DXAdvanced and SMARTDAC+ have physical locking system on its front door, which prevents unauthorized access to the external media and to the power switch.
(2) UTAdvanced has locking function for front operation button and can be used password control for configuration parameters. Both functions prevent unauthorized access and misoperation.

# 4. Detail Description of DXAdvanced/ SMARTDAC+ – Data Security

## 4-1 Briefing

(1) AMS 2750 requires that records are protected so that they can be retrieved readily and accurately throughout any required retention period. This requirement applies not only to records at their time of creation but also to archived electronic records for the duration of their storage period.

## 4-2 Data file Management

(1) DXAdvanced/SMARTDAC+ data files are stored in a proprietary encrypted binary format and as such cannot be modified by ordinary means once they have been created.
(2) Acquired data, such as temperature values, are also stored in a proprietary binary format and cannot be changed once they have been stored. DXAdvanced/SMARTDAC+ maintains records of all alarms, alarm acknowledgements, error messages in the same binary files. These files cannot be changed by users or administrators. An error message will appear the next time anyone attempts to access the data notifying the user that the file is damaged and cannot be viewed.
(3) DAQStandard and Viewer display and print data in human readable form. The files can be easily copied for backups, archiving, inspection, and review.
(4) Neither the DXAdvanced/SMARTDAC+ nor the DAQStandard and Viewer software allow a user to overwrite records, nor do they automatically overwrite records.

## 4-3 Data Security – Data redundancy using the FTP function

(1) An FTP client mode function allows records created by the DXAdvanced/SMARTDAC+ to be automatically sent to a secure FTP server directory for long-term or short-term storage. The DXAdvanced/SMARTDAC+ has the capability of automatically sending a preconfigured username and password combination, if required, for file upload access to the FTP directory. The SMARTDAC+ can also send the files by using SSL encryption.
(2) Access levels at the FTP server directory can be further controlled through good local network security policy.
(3) Data files are stored sequentially to the DXAdvanced/SMARTDAC+ external archive media and then to the FTP server when this function is used. The data record is always archived even if the network connection to the server is lost. If the connection fails, data will be automatically transferred via FTP as soon as the connection is restored. These records can then be maintained under a company's general electronic records archiving policy.

# 5. Detail Description of DXAdvanced/ SMARTDAC+ – Batch Header Function

## 5-1 Briefing

(1) AMS 2750 requires that lots (batches) and sub-lots (sub-batches) of identical parts are to be identified to preclude their mixing and to ensure lot integrity.

## 5-2 Batch header function of DXAdvanced/SMARTDAC+

(1) DXAdvanced/SMARTDAC+ has a Batch header function as standard. Customers can input a batch name and a lot number for each batch record. The batch name together with the lot number can be used as the file name of the data file.
(2) DXAdvanced/SMARTDAC+ can be operated in either a Batch or Continuous mode for data collection.
(3) For both cases above, batch header information is compiled together with the measurement data.
(4) The Viewer software shows batch header information together with the measurement record.

# 6. Description Table – AMS 2750E

Please be noted that this table is referring to AMS 2750 revision E, which was originally established by SAE International. If there are any incompatibilities, the original document always prevails.

| AMS 2750E Requirements | | Comments | |
|---|---|---|---|
| | | DXAdvanced/Smartdac+ | UTAdvanced |
| 6-1 | 3.2.3.1 Minimum Readability | The minimum readability is 0.1 °F or 0.1 °C. | The minimum readability is 0.1 °F or 0.1 °C. |
| | At least one recording and/or controlling instrument for each zone shall have a minimum readability of 1 °F or 1 °C. | | |
| 6-2 | 3.2.3.2 Recommended Installation | The User's Manual for DXAdvanced/Smartdac+ and UTAdvanced clearly shows the correct installation procedure for the instrument. | |
| | Installation of controlling, monitoring or recording instruments shall conform to the manufacturer's recommendations. | | |
| 6-3 | 3.2.4 Offsets | DXAdvanced has up to 15-segment lineariser for each measurement input channel as a configuration option (/CC1).The approximation method is used for linearization.<br>Smartdac+ has up to 11-segment lineariser function for each input channel as standard. Either biasing or approximation method is used for linearization. | UTAdvanced has up to 10-segment linearizer besides bias function for control input channel as a standaed.Either biasing or approximation method is used for linearization. |
| | If offsets are used, a documented procedure shall exist, describing when and how to perform manual and electronic offsets. The procedure shall address how to account for and reintroduce any intentional offsets. Prior to reintroducing any intentional offsets, any instrument calibration error found shall be taken into account. Adjustments (offsets) greater than those shown in Tables 6 or 7 shall not be used. | | |
| 6-4 | 3.2.5.2 Calibration Accuracy | The User's Manual for DXAdvanced/Smartdac+and UTAdvanced describe required instruments and procedure, to ensure its measurement accuracy. | |
| | Calibration accuracy and frequency requirements shall be in accordance with Table 3. | | |
| 6-5 | 3.2.5.3 Calibration | The calibration procedure is clearly described in the User Manual for DXAdvanced/Smartdac+ and UT Advanced | |

| AMS 2750E Requirements | Comments | |
|---|---|---|
| | DXAdvanced/Smartdac+ | UTAdvanced |
| 6-6 3.2.5.3 Sensitivity<br>Sensitivity shall be checked during calibration. See Table 3 footnote 4.<br>Class 3 through 6 instruments shall have a minimum sensitivity of 3°F (2 °C).<br>Class 1 & 2 instruments shall have a minimum sensitivity of 1 °F (1 °C). | Minimum sensitivity of measurement input channel is 0.1 °F and 0.1 °C. | Minimum sensitivity of control input is 0.1 °F and 0.1 °C. |
| 6-7 3.2.7.1.1 Electronic Record – Manipulation<br>The system must create electronic records that cannot be altered without detection.<br>6-8 3.2.7.1.2 Electric Record – Playback<br>The system software and playback utilities shall provide a means of examining and/or compiling the record data, but shall not provide any means for altering the source data. | Acquired data are stored in a proprietary binary format and cannot be changed once they have been stored.Should a user attempt to change any data by directly accessing the binary data, the file will become useless to the user. An error message will appear the next time anyone attempts to access the data notifying the user that the data has been changed and the file cannot be viewed. | Not applicable |
| 6-9 3.2.7.1.3 Electric Record – Data Output<br>The system shall provide the ability to generate accurate and complete copies of records in both human readable and electronic form suitable for inspection, review, and copying. | Users can playback the data record on DXAdvanced/Smartdac+ in trend-graph format. The Viewer software displays and prints data in human readable form using a PC.Such files can be easily copied for backups, archiving, inspection, and review. | Not applicable |
| 6-10 3.2.7.1.3.1 Electric Record – Signature The system shall be capable of providing evidence the record was reviewed- such as by recording an electronic review, or a method of printing the record for a physical marking indicating review. | DXAdvanced/Smartdac+ can provide electronic signature inputs for each record (data file) on 3 user levels. The electronic signature function is also available on the Viewer PC software. | Not applicable |
| 6-11 3.2.7.1.5 Electric Record – Data Access | DXAdvanced/Smartdac+ can prevent any illegal data access by unauthorized users with log-in authentication and/or software-keylock protection. | Not applicable |

# 7. Description Table – AS 7102

Please be noted that this table is referring to AS7102 which was originally established by SAE International. If there are any incompatibilities, the original document always prevails.

| AS 7102 Requirements | | Comments | |
|---|---|---|---|
| | | DXAdvanced/Smartdac+ | UTAdvanced |
| 7-1 | 4.3.1.1 Job Documentation – Traceability | Both have a Batch header function as standard. Customer can provide a batch name and a lot number to each record. A batch name together with a lot number can be used as part of the file name of the measurement data.The Viewer software shows such batch header information together with the measurement record. | Not applicable |
| | Procedures shall specify how lots and sub-lots of identical parts are to be identified to preclude their mixing and to ensure lot integrity. | | |
| 7-2 | 4.3.1.2 Job Documentation – In-Process Documentation | In-process status such as alarm logs and operation logs are combined with the measurement data file. Inspection status and engineering change notice can be recorded as “Batch comment”, combined with the measurement data file.The Viewer software shows such In-process information together with the measurement record data file. | Not applicable |
| | In-process documentation shall include process status, inspection status, engineering change notice, and all other relevant information. | | |
| 7-3 | 4.5.2 Specification changes | Specification change can be recorded as “Batch comment”, which is to be typed by a user, combined with measurement data. The Viewer software shows in-process information together with the measurement record. | Not applicable |
| | Records shall indicate that the procedure is followed and that old specifications are used only when specified. | | |

| AS 7102 Requirements | | Comments | |
|---|---|---|---|
| | | DXAdvanced/Smartdac+ | UTAdvanced |
| 7-4 | 4.7.1 Automated Processes and Recordings – Integrity of the process and records | Both create measurement data in binary encrypted data format in its internal memory.The internal memory is non-volatile. Both keep measurement data securely even when unexpected power failure occurs.Measurement data can be automatically copied to external media mounted on each device. Both have an Ethernet interface as standard. This enables both to send a copy of measurement data file to the designated ftp server via the connected network. | Not applicable |
| | Where automated heat treating processes and/or record-keeping are used, there shall be a system in effect to assure the integrity of the process and records. | | |
| 7-5 | 4.7.2 Automated Processes and Recordings – Authorization | Both can prevent any illegal access by unauthorized users using log-in authentication and/or software-keylock protection. Access to the communication port is controlled by log-in authentication as well. Authorized users can change the setting parameters once they log-in and/or unlock the software-keylock which is password protected. | Not applicable |
| | Procedures shall include a method of ensuring that electronic/magnetic programs can not be altered without authorization. | | |
| 7-6 | 4.7.3 Automated Processes and Recordings – Prevent records from alteration | Both can prevent any illegal access by unauthorized users using log-in authentication and/or software-keylock protection. Both protect measurement data securely. Even authorized users cannot change or manipulate any of measurement record data. | Not applicable |
| | Procedures shall include a method of ensuring that electronic/magnetic record can not be altered. | | |
| 7-7 | 4.7.4 Automated Processes and Recordings – Data back-ups | FTP function is standard, which automatically transfer data files to a particular location in the connected network. This function aims as automated storage of back-up data. | Not applicable |

| AS 7102 Requirements | Comments | |
|---|---|---|
| | DXAdvanced/Smartdac+ | UTAdvanced |
| 7-8 6.3.1 Lot (Batch) Integrity<br>Procedures shall specify how lots (batches) and sub-lots (sub-batch) of identical parts are to be identified to preclude their mixing and to ensure lot integrity. | DXAdvanced has a Batch header function as standard. Customers can provide a batch name and a lot number for each batch. A batch name together with a lot number can be used as part of the file name of each measurement data file.Customer can provide a batch name and a lot number to each batch. For both case of above, batch header information are compiled with measurement record. The Viewer software shows such batch header information together with the measurement record. | Not applicable |
| 7-9 8.1.1.1 Furnace Document Control – Operating Instruction<br>Current operating manuals or instruction manuals shall be available to furnace operators, maintenance personnel and other personnel requiring the information. | The latest versions of the instruction manuals are available on the Internet. Customers can create operation instructions for furnaces by referring to the manuals. | |
| 7-10 8.1.2.1 Furnace Document Control – Heating Times: Controls<br>Procedures shall specify the method for determining heat-up time or start of soaking time and cooling rate. | Not Applicable | UP55A: Customer can specify the start condition,ramp rate (heating and cooling), and soaking time by each segment. PV and time event function and alarm and program function of UP55A's control input helps interlocking, advancing and delaying operation to secure the heating condition.<br><br>UT52A/UT55A: Can be tracked program pattern which is included the start condition,ramp rate, soaking time and alarm information correctly from UP55A by RS485 communication as option.<br>Customer can build zone control for furnace by UP55A and UT55A/UT52A. |
| 7-11 8.1.2.2 Furnace Document Control – Heating Times: Records<br>Records on the furnace chart or log shall indicate that the procedure is followed. | Alarm log and message log are included with the measurement data.DXAdvanced, Smartdac+ as well as the Viewer software can indicate those logs to check if the procedure is followed. | Not applicable |
| 7-12 8.1.2.3 Furnace Document Control – Heating Times: Specified Metal Temperature<br>When metal temperature is specified, records shall demonstrate that the metal was at temperature for the specified time. | The computation option can calculate the time under certain conditions. | PV and time event function and alarm function of UTAdvamced's control input can interlock the operation for furnace. |

| AS 7102 Requirements | | Comments | |
|---|---|---|---|
| | | DXAdvanced/Smartdac+ | UTAdvanced |
| 7-13 | 8.7.1.6 Temperature Uniformity Tests – Thermocouple Corrections | A print-out of the DAQStandard or Smartdac+ Hardware Configurator shows the correction factors used. | Not applicable |
| | Records shall indicate that thermocouple corrections are used. | | |
| 7-14 | 8.7.2.4 System Accuracy (Probe) Test – Operation Log | Both have batch header function as standard. The batch header function in combination with Log-in function enables the recording of “who started the batch at which time” and “who stopped the batch at which time”. Such information together with the additional batch comments are combined with the measurement data file. The Viwer software indicates batch operation log information. | Not applicable |
| | Logs shall show the actual time and date of test and indemnify the operator who performed the test. | | |
| 7-15 | 8.7.3.2 Instrument Calibration – For Working Instruments | DXAdvanced; Accuracy of measurement inputs less than 0.6 °C.<br><br>Smartdac+; Accuracy of measurement inputs less than 0.6 °C. | Accuracy of control input less than 0.6 ° C can be achieved with the use of 10-segment lineariser and bias function. |
| | For working instruments;<br><br>b. For digital instruments, readability shall be within +/- 1 °F or +/- 1 °C | | |

# Revision Information

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