

SCADAPack E Profiler Manual



Documentation

Table of Contents

Part I Profiler Technical	3
1 Technical Support.....	3
2 Safety Information.....	4
3 General.....	6
4 Profile Files.....	8
5 Profiler Start-Up.....	10
6 Profile File Format.....	12
6.1 Structure of Profile File Header	13
6.1.1 Record Format Field.....	14
6.1.2 Value Format Field.....	15
6.2 Structure of Profile Records	16
7 Profiler Operation.....	17
7.1 Initialisation, Transfer of Profiles, & Activation of Profile Files	18
7.2 Profile Errors	19
8 Example Profile File.....	21

I Profiler Technical



Documentation

©2013 Control Microsystems Inc.
All rights reserved.
Printed in Canada.

Version: 8.05.4

The information provided in this documentation contains general descriptions and/or technical characteristics of the performance of the products contained herein. This documentation is not intended as a substitute for and is not to be used for determining suitability or reliability of these products for specific user applications. It is the duty of any such user or integrator to perform the appropriate and complete risk analysis, evaluation and testing of the products with respect to the relevant specific application or use thereof. Neither Schneider Electric nor any of its affiliates or subsidiaries shall be responsible or liable for misuse of the information contained herein. If you have any suggestions for improvements or amendments or have found errors in this publication, please notify us.

No part of this document may be reproduced in any form or by any means, electronic or mechanical, including photocopying, without express written permission of Schneider Electric.

All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed. Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

1 Technical Support

Support related to any part of this documentation can be directed to one of the following support centers.

Technical Support: The Americas

Available Monday to Friday 8:00am – 6:30pm Eastern Time

Toll free within North America 1-888-226-6876

Direct Worldwide +1-613-591-1943

Email TechnicalSupport@controlmicrosystems.com

Technical Support: Europe

Available Monday to Friday 8:30am – 5:30pm Central European Time

Direct Worldwide +31 (71) 597-1655

Email euro-support@controlmicrosystems.com

Technical Support: Asia

Available Monday to Friday 8:00am – 6:30pm Eastern Time (North America)

Direct Worldwide +1-613-591-1943

Email TechnicalSupport@controlmicrosystems.com

Technical Support: Australia

Inside Australia 1300 369 233

Email au.help@schneider-electric.com

2 Safety Information

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

	The addition of this symbol to a Danger or Warning safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.
---	--

	This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.
---	--

⚠ DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result** in death or serious injury.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result** in minor or moderate injury.

CAUTION

CAUTION used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result in** equipment damage..

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and the installation, and has received safety training to recognize and avoid the hazards involved.

BEFORE YOU BEGIN

Do not use this product on machinery lacking effective point-of-operation guarding. Lack of effective point-of-operation guarding on a machine can result in serious injury to the operator of that machine.

⚠ CAUTION

EQUIPMENT OPERATION HAZARD

- Verify that all installation and set up procedures have been completed.
- Before operational tests are performed, remove all blocks or other temporary holding means used for shipment from all component devices.

- Remove tools, meters, and debris from equipment.

Failure to follow these instructions can result in injury or equipment damage.

Follow all start-up tests recommended in the equipment documentation. Store all equipment documentation for future references.

Software testing must be done in both simulated and real environments.

Verify that the completed system is free from all short circuits and grounds, except those grounds installed according to local regulations (according to the National Electrical Code in the U.S.A, for instance). If high-potential voltage testing is necessary, follow recommendations in equipment documentation to prevent accidental equipment damage.

Before energizing equipment:

- Remove tools, meters, and debris from equipment.
- Close the equipment enclosure door.
- Remove ground from incoming power lines.
- Perform all start-up tests recommended by the manufacturer.

OPERATION AND ADJUSTMENTS

The following precautions are from the NEMA Standards Publication ICS 7.1-1995 (English version prevails):

- Regardless of the care exercised in the design and manufacture of equipment or in the selection and ratings of components, there are hazards that can be encountered if such equipment is improperly operated.
- It is sometimes possible to misadjust the equipment and thus produce unsatisfactory or unsafe operation. Always use the manufacturer's instructions as a guide for functional adjustments. Personnel who have access to these adjustments should be familiar with the equipment manufacturer's instructions and the machinery used with the electrical equipment.
- Only those operational adjustments actually required by the operator should be accessible to the operator. Access to other controls should be restricted to prevent unauthorized changes in operating characteristics.

3 General

The SCADAPack E Profile Task (or Profiler) allows the RTU to manipulate values and attributes of binary, analog and counter data points based on time profiles.

The Profiler provides time-based control of data points on a time-of-day and day-of-week basis. The time information is stored in files in the SCADAPack E File System that schedule changes to point attributes

or values.

Point attribute or value changes controlled by the Profiler task are synchronized to occur on the 1-minute boundary of the RTU real time clock.

Profile operations may be based on Local RTU time or Standard time, defined by the profile file. Currently, only Local RTU time operations are supported, and ARE affected by the RTU's Time Zone Modifier system point.

The Profiler can manipulate the following point attributes:

- Analog points: Current Value (integer or engineering), Alarm Limits 4L...4H
- Counter points: Current Value (integer), High Counter Limit
- Binary points: Current State

The user configuration interface for the Profiler is as follows:

- Database "Profile ID" attribute for each point that is used by the Profiler
- Profile files
- Restart the Profile task

Conventions

Data is stored in the profile files in "little-endian" format. In the following information, the least significant Bit is numbered zero. The low order or least significant byte of multi-byte values, or lower address in a byte array, appears first in the file.

4 Profile Files

Profile Files

Each Point in the RTU database can contain a reference to a Profile ID that maps the point to a profile schedule defined by a set of Profile files in the RTU File System. More than one point can use the same Profile ID, and therefore more than one point can use the same set of Profile files. The Profile Files are named such that Profile ID and Day uniquely identify the Profile. A single file only contains data for that day. The File-name format is:

PROFILE_xxx_y

Where **xxx** = Identification Number of this profile (001-999 decimal), and **y** represents the day number:

- 0 = Every Day
- 1 = SUNDAY
- 2 = MONDAY
- 3 = TUESDAY
- 4 = WEDNESDAY
- 5 = THURSDAY
- 6 = FRIDAY
- 7 = SATURDAY

Either a single profile file for a given Profile ID (used for every day of the week, also called "Daily" profile), or individual day-of-week files (one for each day of the week, also called "Weekly" profiles) will usually be loaded into the SCADAPack E file system. For example:

PROFILE_254_0	PROFILE_001_1	PROFILE_001_2
PROFILE_001_3	PROFILE_001_4	PROFILE_001_5
PROFILE_001_6	PROFILE_001_7	etc.

File Storage

The Profiler is sharing the SCADAPack E File System along with other RTU facilities. The RTU file system may contain files for the RTU Trend Sampler, the ISaGRAF Target(s), configuration files, and log files, etc.

The Profiler minimizes its access to RTU the File System by scanning files only when the Profiler is restarted. Between restarts, it maintains internal information regarding profile operation. Also, the Profiler will delete profile files from the file system if it is detected that they are not in use by points in the RTU database. See Section [Start-Up Validation](#)^[10] for more information.

Configuring Points for Use with the Profiler

The Profiler can schedule changes to an RTU database point when the point has a configured Profile ID attribute. This attribute is specified in the RTU configuration file for the point. The Profile ID attribute has valid values 1 to 999. The default value of zero indicates no is profile is active for the point.

The Profile ID attribute associates the point with a scheduled profile. The association is by way of the Profile file's name, which contains the profile ID. The Profile file contains the information required to schedule modifications to the point's attributes, i.e. timing, attributes of point to modify, values of attributes, etc.

The Profile ID attribute of a point may be modified by the SCADAPack E Configurator, or by the Master

station using Record Exchange. Following changes to a point's "Profile ID" attribute, the RTU requires the user to issue a "Restart Profile" SCADAPack E Configurator command, or requires the Master station to issue a File EXEC RESTART PROFILE command.

5 Profiler Start-Up

As RTU re-configuration potentially affects the Profiler operation, the Profiler sub-system within the RTU is notified to restart as part of the RTU's Restart Configuration facilities.

Start-Up Validation

Following RTU re-configuration, the SCADAPack E RTU performs a series of validity checks on the RTU database. The RTU's "Config Corrupt" DNP3 IIN flag is set by the RTU under the following conditions relevant to the operation of the Profiler.

- Valid NV-RAM database point references a Profile ID for which there are no valid Profile files

Note that the "Config Corrupt" DNP3 IIN flag may also be set under other circumstances. For more information see *SCADAPack E DNP3 Technical Reference* for more information.

At initialisation of the Profiler, integrity checks are performed on the RTU point database and profile configurations held in the RTU file system. Profile configuration files are DELETED if they are found in the RTU file system, but are not configured in at least one RTU point's "Profile ID" attribute in the point database.

A Profile ID found in the database without a corresponding profile files cause a DNP3 "Config Corrupt IIN" flag to be set, as described for RTU re-configuration validation.

Restarting the Profiler

Restarting services will impact process control and RTU availability. Assess the impact prior to performing a restart operation.

WARNING

UNEXPECTED EQUIPMENT OPERATION

Evaluate the operational state of the equipment monitored and controlled by the SCADAPack E RTU prior to restarting services.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Changes to the operation of the Profiler will not take effect until after the Profiler has been restarted (re-initialised). The Profiler may be re-initialised in one of the following ways:

- Reset the RTU via a DNP3 Cold Restart, hardware reset or command line "RESTART RTU" command. Profiler re-initializes when the RTU restarts.
- Re-initialize the Profiler via command line by issuing a "RESTART PROFILE" command. Profiler re-initializes immediately.
- Re-initialize the Profiler via SCADAPack E Configurator "Status" page's "Reset Profiler" button. Profiler re-initializes immediately.
- Re-initialize the Profiler via Master Station, or RTU Config by issuing a DNP3 File EXEC command. Use parameters "RESTART PROFILE". Profiler re-initializes immediately.
- If the Time Zone modifier system point state is changed (binary system point 50302), the Profiler automatically re-initializes at the next 1-minute boundary of the SCADAPack E Real Time Clock.

-
- When the day changes on the SCADAPack E real time clock, the Profiler automatically re-initializes.

Re-initializing the Profiler operation can occur whilst an RTU is operating normally. It does not impact other RTU facilities including physical output states, ISaGRAF applications, etc. except indirectly through a new scheduled profile resulting in point attribute or value changes.

6 Profile File Format

Profile files may be sent to an SCADAPack E RTU via the DNP3 protocol file object. RTU Config provides facilities for transferring profile files to the SCADAPack E from a local PC. In addition, host systems may send profile files to the RTU via DNP3.

A Profile file is made up of a profile header, and profile records. The content of profile records varies for different types of points and attributes being modified. Mixed profile record types may be placed in a single profile file.

The File Format consists of:

1 x *FileHeader*

Z x *ProfileRecord*

Where the record format and number of ***ProfileRecords*** (Z) is defined in the ***FileHeader***

6.1 Structure of Profile File Header

The **FileHeader** consists of:

unsigned char	<i>TimeFlag</i>
unsigned char	<i>Unused</i>
unsigned short	<i>RecordFormat</i>
unsigned short	<i>ValueFormat</i>
unsigned short	<i>NumberOfRecords</i>

Where:

Time Flag indicates whether the Profile Time is stored in Standard Time (0) or Local Time (1). This flag is for future use and is not used by the SCADAPack E RTU.

Unused is a reserved byte for future use

Record Format describes the format and size of the values in each *Profile Record* such as binary, signed or unsigned integer or floating point.

Value Format describes the types of values provided in the *Profile Record* (i.e. CV, 4H, 3H, 2H, 1H, 1L, 2L, 3L, 4L)

Number Of Records (Z) identifies the number of *Profile Record* structures following the *File Header*.

File Header Format

Time Flag	Unused
0	1
Record Format	
2 – DNP Object	3 – Variation
Value Format	
4	5
Number of Records	
6	7

- [Record Format Field](#)^[14]
- [Value Format Field](#)^[15]

6.1.1 Record Format Field

The *Record Format* Field has the following format:

Byte 2 (LSB):	DNP Object Group
Byte 3 (MSB):	Format (DNP Variation)

The DNP object type and variation are used solely to define the format of the values in the profile files, rather than the DNP point type for which they are to be applied. For example, Group 30 Variation 4 (16 bit analog input), Group 31 Variation 4 (frozen analog input) and Group 30 Variation 2 specify the same *RecordFormat* as only the format of the “current value” portion of the equivalent DNP object is used.

The *RecordFormat* implicitly describes the size and format of each Value in the data.

Examples are:

Group 1 Variation 2:	1 byte unsigned [indicating binary point state]
Group 20 Variation 5:	4 bytes unsigned
Group 20 Variation 6:	2 bytes unsigned
Group 30 Variation 3:	4 bytes signed
Group 30 Variation 4:	2 bytes signed
Group 30 Variation 5:	4 byte short floating point IEEE-754 format (1 bit (MSB) sign, 8 bits exponent, 23 bits significant)
Group 30 Variation 6:	8 byte long floating point IEEE-754 format (1 bit (MSB) sign, 11 bits exponent, 52 bits significant)

6.1.2 Value Format Field

The *ValueFormat* field is a bit field of 16 bits where a set bit indicates the presence of additional information in the *Data* field of a *Profile Record*:

Bits 15 - 9: Unused (Future bits available for alarm flag, over range, under range, alarm enable etc)

Bit 8: Current Value

Bit 7: 4H, Bit 6: 3H, Bit 5: 2H, Bit 4: 1H,

Bit 3: 1L, Bit 2: 2L, Bit 1: 3L, Bit 0: 4L

Additional information is added to the *Data* field in order from the most significant indicated bit, to the least significant indicated bit.

The following combinations for *Value Format* and *Record Format* are supported:

Type of Profiled Point	Valid <i>ValueFormat</i>	Valid <i>RecordFormat</i>	Profiler action
Analog	Bits 8..0 set in any combination	Group 30 Variation 5	Sets Current Value, 4H..4L alarm limits where specified
	Bit 8 set only	Group 30 Variation 3	Sets Current Value (32 Bit)
		Group 30 Variation 4	Sets Current Value (16 Bit)
		Group 30 Variation 5	Sets Engineering Value (Floating Point)
Counter	Bit 8 and/or Bit 7 Set	Group 20 Variation 5	Preset Counter (32 Bit) Value High Counter Limit
	Bit 8 set only	Group 20 Variation 5	Preset Counter (32 Bit)
		Group 20 Variation 6	Preset Counter (16 Bit)
Binary	Bit 8 set only	Group 1 Variation 2	Most significant bit of data byte sets point Current State

6.2 Structure of Profile Records

The *Profile Record* format is as follows:

unsigned char	<i>Time_hrs</i>
unsigned char	<i>Time_mins</i>
unsigned char	<i>Data[]</i>

Where:

The format for ***Time*** is described below

The format and size of ***Data[]*** is variable and is determined from *ValueFormat* and *RecordFormat* fields.

For example, if 32 bit floating point data is being provided for 2L, 1L, 1H and 2H the *ProfileRecord* is 18 bytes long, consisting of 2 bytes for *Time* and 4 bytes for each of the 4 floating point values. The order of data in the record will be *Time, 2H, 1H, 1L, 2L*.

Time Fields

Time is described by 2 bytes and represents time of day in Hours and Minutes. The format for *Time* is:

Time_hrs: Hours (range 0 – 23 decimal)

Time_mins: Minutes (range 0 – 59 decimal)

The time format permits Profile periods at any minute boundary. For example once every 15 minutes or at a number of specific times (to an accuracy of one minute) during the day.

The Profile Time format currently refers to RTU Local Time. The time used by the Profiler is affected by the “Local Time Offset from UTC” (float system point 63201) and “Time Zone Modifier” (Summer Time / Apply Daylight Savings) system point (binary system point 50302).

When set or cleared by the Master Station for Daylight Savings Time compensation, the Profiler re-initializes the profile operation to suit the adjusted time.

7 Profiler Operation

- [Initialisation, Transfer of Profiles, & Activation of Profile Files](#)¹⁸
- [Profile Errors](#)¹⁹

7.1 Initialisation, Transfer of Profiles, & Activation of Profile Files

Initialisation

Upon start-up, the Profile task searches the SCADAPack E file system for files named:

PROFILE_xxx_y*

The files of this file-name format are opened, and their contents scanned. The Profiler internally maintains the information about the scheduled profile for each Profile Id for each day of the week. The Profiler will re-scan the profile files under the restart conditions described in Section [Restarting the Profiler](#)^[10].

Control profiles for a Profile Id will have one of the following timing characteristics (according to the Profile file-name):

Daily (Every-Day)	(1 profile file used every day)
Weekly (Day-of-Week)	(7 profile files, one for each day of the week)

Individual profile files contain time and data value sets for each profile entry. RTU points using that Profile Id for the point to be modified according to the profile entries. The Profile task activates every 1-minute (at the 1-minute RTU real time clock boundary) to check for required modification of point attributes from an active profile schedule.

Upon Profiler re-initialization, the controlled attributes are set according to the scheduled profile entries at the time of the restart. For example, if a profile has data value sets at 1:00am and 2:00am and the Profiler is re-initialized at 1:30am, the data value sets for 1:00am are re-applied. At 2:00am, the data value sets for 2:00am will be applied.

Changing the file contents for a control profile will not take effect until the profile task has been re-initialized, or at midnight for the profile day the file change is made.

Transfer of Profiles

Profile files may be transferred to the RTU using either FTP or by DNP3 file transfer (Object 70 Variation 1) where:

- Each file is a complete record for the profile values and times relevant to the Profile ID and Day of the week, as indicated in the file name.
- Each file may contain between 1 and 1440 *ProfileRecords*.
- The RTU replaces an existing file of the same name with the new file. However, the profiler will not automatically use the new file until it is restarted.

Activation of Profile Files

The Master Station may choose to delete any profile files that are not required in the RTU. The Master Station may use a File EXEC "Delete" command for this. Alternatively, the Master Station may leave the files to be cleaned up by the RTU. The Profiler automatically removes old files not referenced in the Point database when it restarts.

After the Master Station has transferred relevant profile files to the RTU, a File EXEC "Restart Profile" command should be issued to trigger the RTU to start using the new Profile files.

7.2 Profile Errors

The SCADAPack E Profiler may generate the following errors in the RTU Error Code system point (integer analog system point 50020). Some conditions may potentially generate multiple consequential errors. The first error generated by the Profiler after initialisation or re-initialisation will suppress further errors.

Code	Error	Description
1020	Bad Profile File-name	A Profile file has a file-name that is not in the correct format
1021	Bad Profile Data	A Profile file contains invalid profile data – see RTU diagnostic output
1022	Profile Format Mismatch	A profile is attempting to set an attribute not valid for the point type
1023	Profile Daily / Weekly Error	A profile has both Daily and Weekly files – remove the incorrect file(s)
1024	Missing Profile File	An RTU point is configured to use profile files that are not loaded in the RTU
1025	Profile Write Error	Error occurred writing profile data to a point attribute – see RTU diagnostic output
1026	Profile Initialization Error	Error initializing profile (general error) – see RTU diagnostic output

When using profile files, the following recommendations are made:

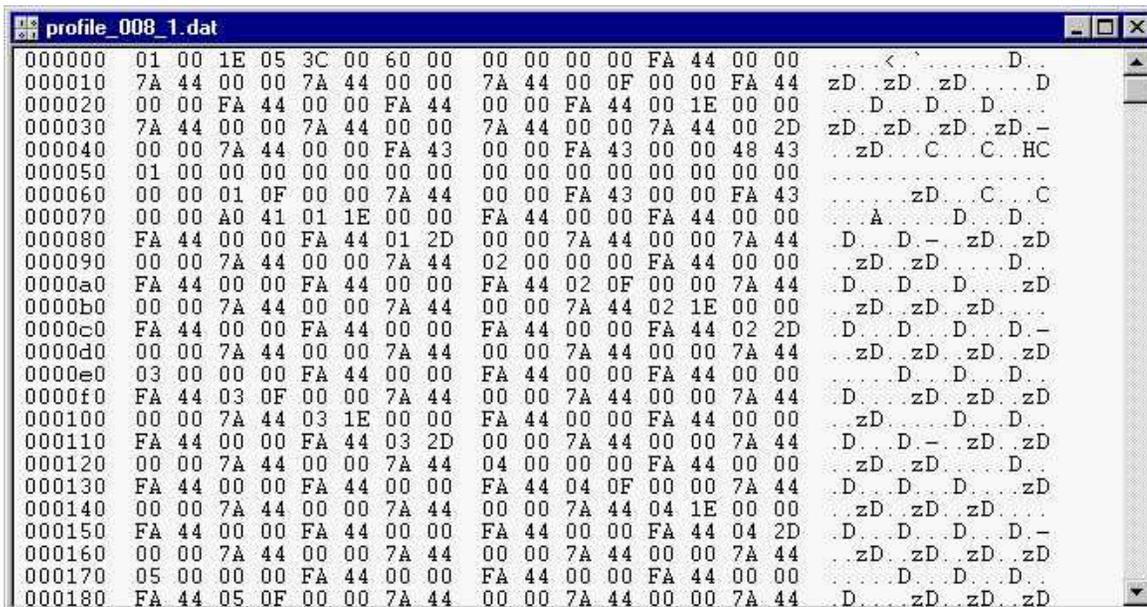
- Avoid mixing daily (every-day) and weekly (day-of-week) profile files for the same Profile Id
- Where weekly profiles are used, create profile files for every day of the week
- Use *value formats* appropriate to the *record format* used. See Section [Value Format Field](#)¹⁵.
- Where profile files are downloaded automatically from a host, it is suggested that downloads occur to a temporary file. Once successfully down-loaded, a previous profile of the desired name can be deleted, and the new temporary file be renamed to the final name.
- After profile files are successfully loaded, the Profile Task should be restarted for changes to take affect.
- The Profiler determines, for each Profile ID, “Daily” (every-day) or “Weekly” (day-of-week) profile format based on first type of file found. If a daily (every-day) file is found after a weekly (day-of-week) file, the daily file is ignored and an error is generated.

Notes:

An error will not be generated if a weekly (day-of-week) profile file is found after a daily (every-day) file, as Weekly profile files have priority over Daily files. A previously configured daily profile schedule will be replaced by Weekly schedules.

Invalid Daily profile files rejected following configuration of Weekly profile files may be corrected by deleting the incorrect data files (locally or remotely). Alternatively change the ProfileID attribute on the point and restart the Profiler, thereby deleting profile files for the unused Profile ID.

8 Example Profile File



File Name	Profile ID	Day	Record Format Group / Var	Value Format	Num Records	Hr:Min	Data			
							2H	1H	1L	2L
PROFILE_008_1.DAT	8	Sunday	30 / 5 [float]	2H ... 2L	96	00:00	2000.0	1000.0	1000.0	1000.0
						00:15	2000.0	2000.0	2000.0	1000.0
						00:30	1000.0	1000.0	1000.0	1000.0
						00:45	1000.0	500.0	500.0	200.0
						01:00	0.0	0.0	0.0	0.0
						01:15	1000.0	500.0	500.0	20.0
						01:30	2000.0	2000.0	2000.0	2000.0
						01:45	1000.0	1000.0	1000.0	1000.0

						02:00	2000.0	2000. 0	2000.0	2000.0
						02:15	1000.0	1000. 0	1000.0	1000.0
									
