3RW55 soft starter - Reading and writing data sets with S7-1500 and HMI connection

3RW5 Soft Starters

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1 Introduction

1.1 Overview

This application example offers you a solution how to read and write parameters, diagnostics, measured values and statistic data from/to 3RW55 Soft starter connected to S7-1500 PLC via HMI during operation.

1.2 Mode of operation

The parameters of the 3RW55 Soft starter can be read or written via data sets. These data sets are read via the RDREC function and written via the WRREC function. This function are running in the PLC. More information on the setup of the different data structures can be found in the manual of the 3RW55 Soft starter (see/3/). In this application example, reading and writing the data sets is exemplary demonstrated by using 3RW5513 Soft starter. The functions are executed with a S7-1500 PLC and 3RW5513 Soft starter. The functions of the application example can be executed for all types of the 3RW55 Soft starter in combination with the communication module PROFINET or PROFIBUS. To facilitate the use of the data sets, this application example uses the data types for the 3RW55 Soft starter. These data sets can be found in the Industry Online Support (see/4/). For the understanding of the application example, the following knowledge is assumed and therefore not further explained in the application example:

- TIA Portal and WinCC configuration software
- Basics of STEP 7 programming
- Programming in SCL

1.3 Components used

This application example has been created with the following hardware and software components:

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<td>FW V2.5</td>
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<td>1</td>
<td>6AV2124-0MC01-0AX0</td>
<td>Version 15.1.0.0</td>
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<td>SIMATIC STEP 7 Professional V15.1</td>
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<td>Soft starter ES V15.1 Premium</td>
<td>1</td>
<td>3ZS1320-6CC11-0YA5</td>
<td>Version 15.1 Premium Update 1</td>
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2 Engineering

2.1 Hardware setup

The control system setup from the network view in TIA Portal is exemplary shown in the following figure and may vary from your configuration.

Figure 2-1 Structure of control system

2.2 Configuration and Setting

Trouble-free use of the 3RW55 Soft starter requires usage of compatible FW version for all components of the Soft starter (HMI V2.0, PROFINET IO V1.0, Soft starter V2.0). More information about the system structure with the 3RW5513 Soft starter can be found in "Documentation " (see [3] and [4]).

Figure 2-2 Hardware configuration 3RW55 system
2.3 Hardware identifier (HW ID)

Hardware identifier can be found in Devices & networks.

Figure 2-3 Soft starter selection

Soft starter has to be selected then go to “Properties” and select “System constants”. Proper HW ID must be chosen.

Figure 2-4 List of Hardware identifiers of selected soft starter
3 Engineering

3.1 Description of interface

To be able to integrate the functions of the application example into your project, the "Name of this example" project is available to you as download (2). The program sequence remains the same for any number of Soft starters used in the system and it doesn’t need to be adjusted to your setup. This example is built with one 3RW5513 Soft starter.

Figure 3-1 Program structure

The application example offers the following contents:
- HMI_1: this is the complete HMI project
- PLC data types: in this folder all data types created for the project have been integrated
- PLC program blocks: this folder contains all the program blocks, FBs, FCs and DBs necessary for the creation of this application example
- PLC tags: Contains the created tag chart for the example

To facilitate the use of the data sets, this application example uses the data sets for the 3RW55 Soft starter. These data sets can be found in the User Manual of the PROFINET communication module for 3RW5 Soft Starters available in Industry Online Support (see /4/). The "3RW55" folder inside "PLC data types" with data sets has been newly created for this example. In this folder, all available data sets for the 3RW55 Soft starter have been integrated. It serves to assign the data of the 3RW55 Soft starter, that are stored in “DataOperations [DB2]”.

In the following chapters, the program blocks are explained.
3.1.1 “ParametrizeSoftstarter [FB2]"

Via the “ParametrizeSoftstarter[FB2]” function block all data operations can be reached. This function block contains read, write and reparameterization operations.

Figure 3-2 Connected "ParametrizeSoftstarter"

The only input which is needed for proper execution is the Hardware identifier which is automatically given to the Soft starter. The hardware identifier needs to be written in the IO Field in the HMI panel. More information about hardware identifier can be found here.

3.1.1.1 “Read record”

The main function of the read example of the data sets is realized via the “ParametrizeSoftstarter [FB2]” function block. The data sets are read via the RDREC function in the PLC. The following data sets are read:

- Process image output (Data set 68)
- Process Image input (Data set 69)
- Soft starter diagnostics (Data set 92)
- Commands (Data set 93)
- Measured values (Data set 94)
- Statistic data (Data set 95)
- Maximum pointer (Data set 96)
- Parameter basic functions – Set 1,2 and 3 (Data set 131,141 and 151)

This block does not need to be called up separately for each motor starter in the system. The information that is read from the data sets are stored in the “ParametrizeSoftstarterDB[DB3]” data block under name of the data set. Data inside data block are valid for Hardware identifier which is chosen in the HMI IO Field and after valid read request.
3.1.1.2 “Write record”

The main function of the write example of the data sets is realized via the “ParametrizeSoftstarter [FB2]” function block. The data sets are written via the WRREC function in the PLC. The following data sets can be written:

- Parameter basic functions – Set 1, 2 and 3 (Data set 131, 141 and 151)

This block does not need to be called up separately for each soft starter in the system. The information is written inside data types in the “ParametrizeSoftstarterDB[DB3]” data block. Data inside the data block is valid for the Hardware identifier which is chosen in the HMI IO Field.

3.1.1.3 “Bit manipulation”

Inside the data sets are a few parameters which use more bits at once (Bit2/Bit4 Data type). This function splits the Byte into Bit2/Bit4 and allows to read and write them according to the documentation.
3.2 Operating the application example

3.2.1 Overview

The HMI project consists of 9 screens. These screens display the read information from the data sets of the used 3RW55 Soft starter. Besides the system diagnostics window, a start and a settings screen are also integrated. In the following, it will be described in detail how to operate the individual screens.
3 Engineering

3.2.2 Toolbar

The toolbars, which are located in two places in the screen, allow the selection of the different screens.

- Messages
- Diagnostics
- Settings
- Overview
- Diagnostics
- Measured values
- Statistic data
- Parameter basic functions

Figure 3-4 Location of toolbars
3.2.3 System diagnostics window

A “Diagnostics” button to call up the system diagnostics window is integrated in the “Device control” toolbar.

The System diagnostics window offers you an overview of all available devices which are connected inside network. Navigation is done directly to the cause of the error and to the respective device. You have access to all diagnostics-cap.

Figure 3-5 System diagnostic screen
3.2.4 Using faceplates

In this application example, the contents of the HMI screens are generated as faceplates. A faceplate is a block that makes it easier for you to connect the individual process tags to the HMI. You also get the advantage of being able to use the faceplate for several panels and to adjust it for each panel size. Further information on faceplates can be found in the Industry Online Support (5). To connect the process tags to the faceplate, click on the faceplate and go to “Interface”. Now, all process tags to be connected are displayed.

3.2.5 Selecting the motor starter

To receive the correct values of the desired Soft starter, you need to type the Hardware identifier of the Soft starter in the I/O Field of the HMI called “HW ID of Soft Starter”. Devices & networks – Soft starter – System constants. The field is located in the upper left corner.

Figure 3-6 Hardware identifier of soft starter
3.2.6 Diagnostics

In the HMI screen “Diagnostics”, the diagnostics of the Soft starter are shown (Data set 92). This provides you with the diagnostic status of the selected Soft starter.

Figure 3-7 Screen “Diagnostics”
3 Engineering

3.2.7 Measured values

In the HMI screen “Measured values”, the values of the Soft starter are shown (Data set 94). This provides actual values that are measured by the selected Soft starter.

Figure 3-8 Screen “Measured values”
3.2.8 Statistic data

In the HMI screen “Statistic data”, the statistics and maximum pointers of the Soft starter are shown (Data sets 95 and 96). This provides statistical values of the selected Soft starter.

Figure 3-9 Screen “Statistic data”
3.2.9 Parameters basic functions

In the HMI screen “Parameter basic functions”, some basic representative parameters of the Soft starter are shown for each parameter set (1, 2 and 3). This application example provides only some representative parameters of the 3RW55 soft starter. For the complete list of available parameters please refer to the User Manual of the 3RW5 Communication Module PROFINET, Data Set 131. This data set can be found in the Industry Online Support (see 4).

Figure 3-10 Screen “Parameter basic functions”
3.2.9.1 Parameters basic functions overview

In the red field is a toolbar where data sets can be switched. The parameter list (blue field) shown corresponds to the selected soft starter (over HW-ID) and the selected parameter set.

The parameter list shows the actual value of the parameter and offers the possibility to modify it.

Figure 3-3 Screen “Parameter basic functions”
3.2.9.2 Modify button

After clicking on the “Modify” button on one of the parameters from the list, the following screen will be shown.

Figure 3-12 Pop-up window

The pop-up window contains the “Range of values” which can be written inside Soft starter (Other values are not supported and will not be written). After choosing of value write it inside I/O field and click on the Write button. Click close to close the pop-up window. Read of actual values will be performed automatically after closing pop-up window.
3 Engineering

3.3 Implementing the Screens/the function block to the new project/program

3.3.1 Implementing of PLC

This application example was tested with the PLC mentioned above, Change of device may cause unexpected errors. PLC can be implemented by simple drag and drop.

3.3.2 Implementing of program blocks

Program blocks can be drag and dropped to a program but PLC data types and PLC tags must be also copied.

3.3.3 Implementing of PLC data types

PLC data types can be used independently from this application example.

3.3.4 Implementing of HMI

HMI can be used also in other projects by simple drag and drop. Version of the HMI is in description above. Usage of any other HMI may cause unexpected errors.

3.3.5 Implementing of HMI screens

HMI screens can’t be implemented standalone without rework of the screen.
3.4  Settings screen

3.4.1  Display settings

In the Display settings screen are buttons which allow to Calibrate the touch screen and to clean screen.

Figure 3-13 Display settings screen
3.4.2 System settings

In the System settings screen are buttons which allow to open the Command prompt, Task manager, On-screen keyboard and Control panel.

Figure 3-14 System settings screen
4 Additional information

General functions of this Application example offer a solution on how to read parameters from soft starter and set them via write function from the HMI. Some problems which may occur are described below.

4.1 Problems with RDREC function

Settings of the RDREC function must be done as described in picture below. If the RDREC function is not working check list below.

- Check ID – Proper HW ID must be chosen and set
- Check INDEX – Index must be set to valid number of data set
- Check LENGTH – Length must be same as length of data set
- Check RECORD – Check in which data block are RDREC stored

Figure 4-1 RDREC function

```plaintext
6 [REGION] Reading from dataset 68 / Process Image Output
7 //Request bit for reading dataset 68
8 // [instReadProcessImageOutput.REQ := #instReadProcessImageOutput.REQ;
9 //Hardware identifier of soft starter
10 ID := #HWID;
11 //Index of dataset to access
12 INDEX := #INDEX_PROCESS_IMAGE_OUTPUT,
13 //Length of structure
14 MLEN := #LENGTH_PROCESS_IMAGE_OUTPUT,
15 //Valid status after read request
16 VALID := "DataOperations".statusReadProcessImageOutput.valid,
17 //Busy status after read request
18 BUSY := "DataOperations".statusReadProcessImageOutput.busy,
19 //Error during read
20 ERROR := "DataOperations".statusReadProcessImageOutput.error,
21 //Status code of Error
22 STATUS := "DataOperations".statusReadProcessImageOutput.status,
23 //DB to store values from reading
24 RECORD := "DataOperations".dataSetProcessImageOutput);
25
26 [END_REGION]
```
4 Additional information

4.2 Problems with WRREC function

Settings of the WRREC function must be done as described in picture below. If the WRREC function is not working check list below.

Check ID – Proper HW ID must be chosen and set

Check INDEX – Index must be set to valid number of data set

Check LENGTH – Length must be same as length of data set

Check RECORD – Check in which data block are RDREC stored

Set slot number – Slot number in the data block where parameters are written must be set on value 2.

Set coordination – Coordination in the data block where parameters are written must be set on value 16#21.

Reset REQ bit – Request bit must be reset after valid write and also if error in write occurs.

Figure 4-2 WRREC function

```
147 //WRREC Writing to Dataset 131 / Parameter basic functions parameter set 1
148
149 #instWRRECParameterBasicFunctionsSet1(REQ := "DataOperations".requestWriteParameterBasicFunctionsSet1,
150   //HMI ID must be same as used for RDREC
151   ID := #HMI,
152   //Index of a data set
153   INDEX := #INDEX_PARAMETER_BASIC_FUNCTIONS_SET_1,
154   //Length must be exactly the same as length of dataset
155   LENGTH := #LENGTH_PARAMETER_BASIC_FUNCTIONS_SET_1,
156   //Valid status
157   DONE := "DataOperations".statusWriteParameterBasicFunctionsSet1.valid,
158   //Busy status
159   BUSY := "DataOperations".statusWriteParameterBasicFunctionsSet1.busy,
160   //Error status
161   ERROR := "DataOperations".statusWriteParameterBasicFunctionsSet1.error,
162   //Code of error
163   CODE := "DataOperations".statusWriteParameterBasicFunctionsSet1.status,
164   //Place to store DB must be set to RDREC record DB
165   RECORD := "DataOperations".datasetParameterBasicFunctionsSet1;
166
167   "DataOperations".datasetParameterBasicFunctionsSet1.slotNumber := #SLOT_NUMBER;
168
169   "DataOperations".datasetParameterBasicFunctionsSet1COORDINATION := #COORDINATION_TRUE;
170
171   //When Error while writing parameter occurs request bit set to False
172   IF "DataOperations".statusWriteParameterBasicFunctionsSet1.error = TRUE THEN
173     "DataOperations".requestWriteParameterBasicFunctionsSet1 := FALSE;
174   ELSE
175     END_IF;
176
177   //Reset request bit after valid writing
178   IF "DataOperations".statusWriteParameterBasicFunctionsSet1.valid = TRUE THEN
179     "DataOperations".requestWriteParameterBasicFunctionsSet1 := False;
180   ELSE
181     END_IF;
182
183 "WRREC_ROUTIN
```
5 Appendix

5.1 Service and support

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Breslauer Str. 5
90766 Fürth, Germany
mailto: support.automation@siemens.com

5.3 Links and literature

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