

3m.ANALYSING AND UNDERSTANDING OTHER COMPONENTS

3m.1 Inverter PowerFlex 40

The Allen-Bradley PowerFlex 40 AC drive is the smallest and most cost-effective member of the PowerFlex family of drives. The PowerFlex 40 is designed to be used for speed control in applications such as machine tools, fans, pumps and conveyors and material handling systems. The main features of the PowerFlex40 AC drive are:

- integral keypad for simple operation and programming,
- 4 digit display with 10 LED indicators for display of drive status,
- communication with PC using the RS-485 interface, Ethernet/IP (also DeviceNet, PROFIBUS DP, LonWorks and ControlNet interface are available),
- Autotune allows the user to take into account individual motor characteristics,
- Sensorless Vector Control provides exceptional speed regulation and very high levels of torque across the entire speed range of the drive,
- built-in PID controller
- Timer, Counter, Basic Logic and StepLogic functions
- built-in digital and analog I/O (2 analog inputs, 7 digital inputs (4 fully programmable), 1 analog output, 3 digital output)
- easy set-up over the network (RS NetWorx property)

3m.2 Configuration of the PowerFlex40

Configuration of the PowerFlex40 AC drive requires a correctly prepared RSLogix500 project. Adding the PowerFlex40 as a new module to an existing project is done in the following way:

- 1) Open the **I/O Configuration** folder in the existing RSLogix500 project. Expand the folder tree and find the **1769-L35 Ethernet Port LocalENB** item. Click the right mouse button on the **Ethernet** item to activate the context menu and select **New Module....**
- 2) Select **PowerFlex 40-E** from the list and click the **OK** button. The **New Module** properties window will appear (Fig. 3m.1). The following parameters should be entered:
Name: PF40E

IP Address: 192.168.1.5

Revision: 3.3

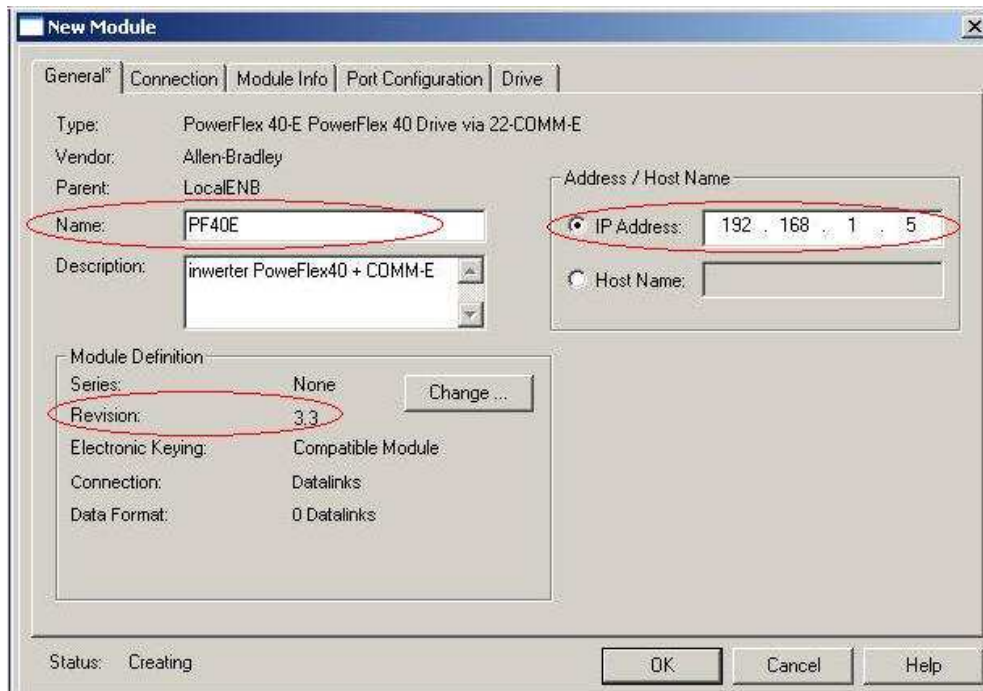


Fig.3m.1 The New Module properties window

- 3) Press the **OK** button to save the configuration.
- 4) The configuration can be downloaded to the CompactLogix controller. Select the **Communication** **Download** item from the program menu. If the configuration download is successful the **I/O OK** indicator will be green.

3m.3 Detailed configuration of the PowerFlex40

- 1) Open the **I/O Configuration** folder in the existing RSLogix500 project. Expand the folder tree and find **PowerFlex 40-E**. Click the right mouse button and select **Properties** (Fig. 3m.2)

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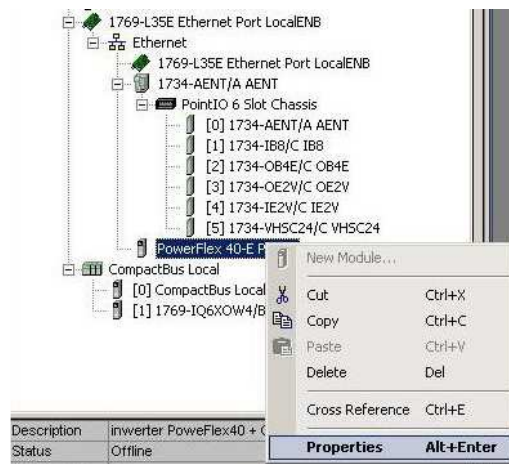


Fig. 3m.2: Properties of the PowerFlex40

- 2) Select the last tab – **Drive**, the window presented in Fig. 3m.3 will appear.



Fig. 3m.3: The 'Drive' tab of the Module Properties

- 3) Select **Parameter list** from the menu PowerFlex 40, the parameter window is presented in Fig. 3m.4.

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ID	Name	Value	Units	Internal Value	Min	Max
1	Output Freq	0.0	Hz	0	0.0	999.9
2	Commanded Freq	0.0	Hz	0	0.0	999.9
3	Output Current	0.00	A	0	0.00	4.60
4	Output Voltage	0.0	V	0	0.0	999.9
5	DC Bus Voltage	0	V	0	0	1200
6	Drive Status	0000000000000000		0	00000000...	00000...
7	Fault 1 Code	0		0	0	9999
8	Fault 2 Code	0		0	0	9999
9	Fault 3 Code	0		0	0	9999
10	Process Display	0		0	0	9999
12	Control Source	0		0	0	255
13	Control In Status	0000000000000000		0	00000000...	00000...
14	Dig In Status	0000000000000000		0	00000000...	00000...
15	Comm Status	0000000000000000		0	00000000...	00000...
16	Control SW Ver	0.00		0	0.00	99.99
17	Drive Type	0		0	0	7000
18	Elapsed Run Time	0	x10h	0	0	9999
19	Testpoint Data	0000000000000000		0	00000000...	11111...
20	Analog In 0-10V	0.0	%	0	0.0	999.9
21	Analog In 4-20mA	0.0	%	0	0.0	999.9
22	Output Power	0.00	kW	0	0.00	99.99
23	Output Power Fctr	0.0	deg	0	0.0	999.9
24	Drive Temp	0	C	0	0	120
25	Counter Status	0		0	0	9999
26	Timer Status	0	Sec	0	0	9999
28	Stp Logic Status	0		0	0	8
29	Torque Current	0.00	A	0	0.00	4.60
31	Motor NP Volts	230	V	230	34	230
32	Motor NP Hertz	60	Hz	60	10	400
33	Motor OL Current	2.3	A	23	0.0	4.6
34	Minimum Freq	0.0	Hz	0	0.0	400.0
35	Maximum Freq	60	Hz	60	0	400
36	Start Source	Keypad		0	Keypad	Monst...
37	Stop Mode	Ramp, CF		0	Ramp, CF	Ramp...
38	Speed Reference	Drive Pot		0	Drive Pot	Anlg L...
39	Accel Time 1	10.0	Sec	100	0.0	600.0
40	Decel Time 1	10.0	Sec	100	0.1	600.0
41	Reset To Defaults	Ready/Idle		0	Ready/Idle	Facto...
43	Motor OL Ret	Disabled		0	Disabled	Enabled
51	Digital In1 Sel	Preset Freq		4	Not Used	EM Br...
52	Digital In2 Sel	Preset Freq		4	Not Used	EM Br...
53	Digital In3 Sel	Local		5	Not Used	EM Br...
54	Digital In4 Sel	Jog Forward		11	Not Used	EM Br...
55	Relay Out Sel	Ready/Fault		0	Ready/Fault	EM Br...
56	Relay Out Level	0		0	0	9999
58	Opto Out1 Sel	MotorRunning		2	Ready/Fault	EM Br...
59	Opto Out1 Level	0		0	0	9999
61	Opto Out2 Sel	At Frequency		1	Ready/Fault	EM Br...
62	Opto Out2 Level	0		0	0	9999
64	Opto Out Logic	1=NO / 2=NC		0	1=NO / 2...	1=NC...
65	Analog Out Sel	OutFreq 0-10		0	OutFreq 0-10	Setp...
66	Analog Out High	100	%	100	0	800
67	Accel Time 2	20.0	Sec	200	0.0	600.0

Fig. 3m.4. The Parameter List window.

Only the parameters on a white background can be changed. The selected parameters are shown in Table.3m.1. Detailed descriptions of all parameters are included in [1].

Table 3m.1:

ID	Name of parameter	Description
31	31 Motor NP Volts	Set to the motor nameplate rated volts.
32	32 Motor NP Hertz	Set to the motor nameplate rated frequency.
33	33 Motor OL Current	Set to the maximum allowable motor current.
34	34 Minimum Freq	Sets the lowest frequency the drive will output continuously.
35	35 Maximum Freq	Sets the highest frequency the drive will output.
36	36 Start Source	Sets the control scheme used to start the drive.
37	37 Stop Mode	Active stop mode for all stop sources

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38	38 Speed reference	Sets the source of the speed reference to the drive.
39	39 Accel Time 1	Sets the rate of acceleration for all speed increases.
40	40 Decel Time 1	Sets the rate of deceleration for all speed decreases.
41	Reset To Defaults	Resets all parameter values to factory defaults.
43	Motor OL Ret	Enables/disables the Motor Overload Retention function.
51	Digital In1 Sel (I/O Terminal 05)	Selects the function for the digital inputs.
52	Digital In2 Sel (I/O Terminal 06)	Selects the function for the digital inputs.
53	Digital In3 Sel (I/O Terminal 07)	Selects the function for the digital inputs.
54	Digital In4 Sel (I/O Terminal 08)	Selects the function for the digital inputs.
55	Relay Out Sel	Sets the condition that changes the state of the output relay contacts.
56	Relay Out Level	Sets the trip point for the digital output relay if the value of 55 [Relay Out Sel] is 6, 7, 8, 10, 16, 17, 18 or 20.
58	Opto Out1 Sel	Determines the operation of the programmable opto outputs.
61	Opto Out2 Sel	
59	Opto Out1 Level	Determines the on/off point for the opto outputs when 58 or 61 [Opto Outx Sel] is set to option 6, 7, 8, 10, 16, 17, 18 or 20.
62	Opto Out2 Level	
64	Opto Out Logic	Determines the logic (Normally Open/NO or Normally Closed/NC) of the opto outputs.
65	Analog Out Sel	Sets the analog output signal mode (0-10V, 0-20mA, or 4-20mA).
66	Analog Out High	Scales the Maximum Output Value for the 65 [Analog Out Sel] source setting.
67	Accel Time 2	When active, sets the rate of acceleration for all speed increases except jog.
68	Decel Time 2	When active, sets the rate of deceleration for all speed decreases except jog.
69	Internal Freq	Provides the frequency command to the drive when 38 [Speed Reference] is set to 1 "Internal Freq".

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70	Preset Freq 0	Provides a fixed frequency command value when 51-53 [Digital Inx Sel] is set to 4 "Preset Frequencies".
71	Preset Freq 1	
72	Preset Freq 2	
73	Preset Freq 3	
74	Preset Freq 4	
75	Preset Freq 5	
76	Preset Freq 6	
77	Preset Freq 7	
78	Jog Frequency	Sets the output frequency when a jog command is issued.
79	Jog Accel/Decel	Sets the acceleration and deceleration time when a jog command is issued.
80	DC Brake Time	Sets the length of time that DC brake current is "injected" into the motor.
81	DC Brake Level	Defines the maximum DC brake current, in amps, applied to the motor when 37 [Stop Mode] is set to either "Ramp" or "DC Brake".
82	DB Resistor Sel	Enables/disables external dynamic braking.
83	S Curve %	Sets the percentage of acceleration or deceleration time that is applied to the ramp as S Curve.
84	Boost Select	Sets the boost voltage (% of 31 [Motor NP Volts]) and redefines the Volts per Hz curve.
126	Motor NP FLA	Set to the motor nameplate rated full load amps.
127	Autotune	Provides an automatic method for setting 128 [IR Voltage Drop] and 129 [Flux Current Ref], which affect sensorless vector performance.
128	IR Voltage Drop	Value of volts dropped across the resistance of the motor stator.
129	Flux Current Ref	Value of amps for full motor flux.
132	PID Ref Sel	Enables/disables PID mode and selects the source of the PID reference.
133	PID Feedback Sel	Selects the source of the PID feedback.

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134	PID Prop Gain	Sets the value for the PID proportional component when the PID mode is enabled by 132 [PID Ref Sel].
135	PID Integ Time	Sets the value for the PID integral component when the PID mode is enabled by 132 [PID Ref Sel].
136	PIDDiff Rate	Sets the value for the PID differential component when the PID mode is enabled by 132 [PID Ref Sel].
137	PID Setpoint	Provides an internal fixed value for process setpoint when the PID mode is enabled by 132 [PID Ref Sel].
138	PID Deadband	Sets the lower limit of the PID output.
139	PID Preload	Sets the value used to preload the integral component on start or enable.

The parameters can be uploaded from the inverter and downloaded to the inverter. Click the appropriate icon in the Module Properties window (Fig. 3m.5) and select **PowerFlex40** from the list. Next, select the type of parameters – parameters of inverter and parameters of COMM-E card are available. Click the Download/Upload button to proceed.

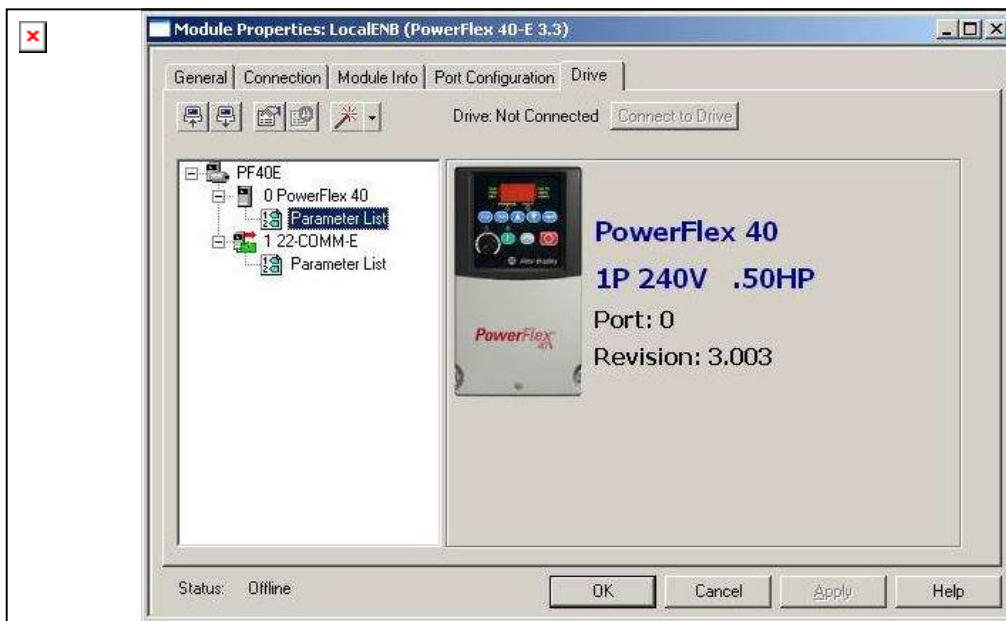


Fig.3m.5. Description of the icon function

Another way to configure the PowerFlex40 inverter is Velocity StepLogic Setup Wizard. To activate the Wizard click the appropriate icon in the Module Properties window (Fig.

3m.5). The window of the Wizard will appear (Fig. 3m.6). The Wizard goes through seven steps to configure the parameters of the inverter.



Fig. 3m.6. The Velocity StepLogic Setup Wizard window

3m.4 HMI (Human Machine Interface) PanelView Plus 600

The PanelView Plus 600 is an operator interface. It is equipped with a 5.5 inch display with touch screen. It works from Windows CE. The panel offers many possibilities for presenting data such as animations, trends and data collection. Visualization can be implemented using the RSView Studio environment. Communication with the panel is through the Ethernet interface. Data exchange between Ethernet/IP devices and PanelView uses the OPC client/server mechanism.

The existing PanelView Plus600 has the Ethernet/IP parameters correctly configured. To check the configuration, close the active project and find the key **Go To Configure**. The main window of the operating system will appear (Fig. 3m.7).

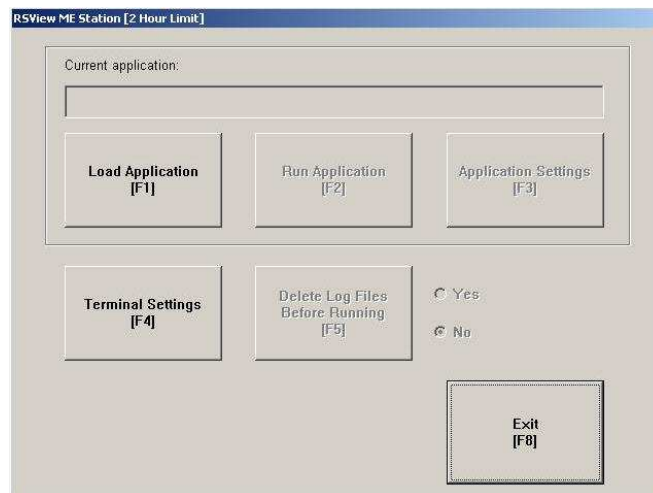


Fig. 3m.7. The Panel View configuration window

Next, click the **Terminal Settings [F4]** button and check the **Network and Communications** **Network Connections** **Network Adapters** **Built-in Ethernet Controller** menu. The valid parameters are:

IP Address: 192.168.1.3
 Subnet Mask: 255.255.255.0
 Gateway: 0.0.0.0

Menu **Terminal Settings** allows the user to check or change other parameters:

- **Alarms** – alarm parameters
- **Diagnostic Setup** – the choice of diagnostic messages to be displayed
- **Display** – display parameters (brightness, contrast, temperature, cursor, etc)
- **File Management** – manage the files in the memory panel (load, copy, delete, etc)
- **Font Linking** – font settings
- **Input Devices** – settings of the USB devices (keyboard, mouse, etc)
- **Print Setup** – settings of the printing method
- **Startup Options** – startup method: running application or parameter window
- **System Event Log** – list of the system logged messages
- **System Information** – firmware version, working time, etc
- **Time/Date/Regional Settings** – actual date and time

To prepare your own HMI interface you can use **RSView Studio** software.

Creating the new project:

1. click *File -> New application*, the window (Fig. 3m.8) will appear
2. fill in *Application Name* in the **New** tab, select language, prepare the short description (optional) and click **Create**.

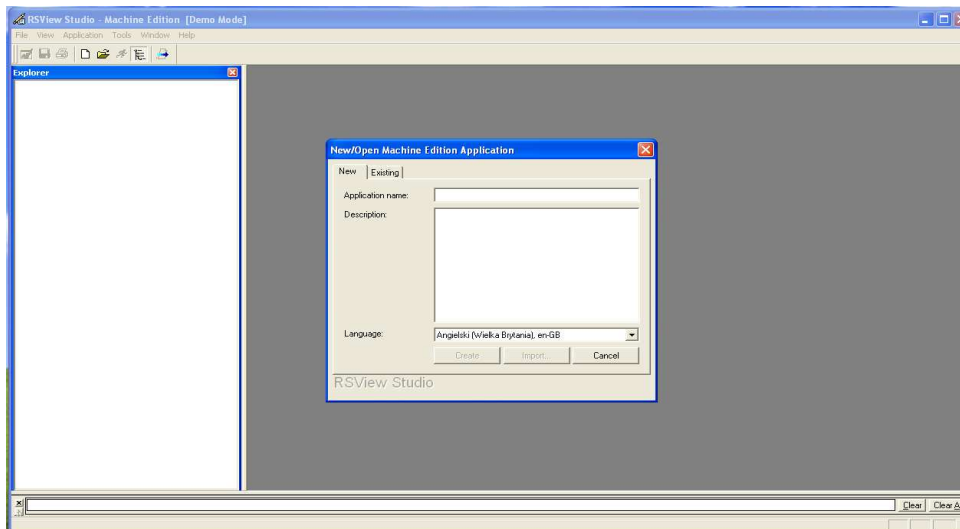


Fig. 3m.8. Creating of the new PanelView project

3. The empty project is created. Click the **Project Settings** – the window will appear (Fig.3m.9). Set the **Project window size** parameter to 320x240. It is maximum resolution of the PanelView

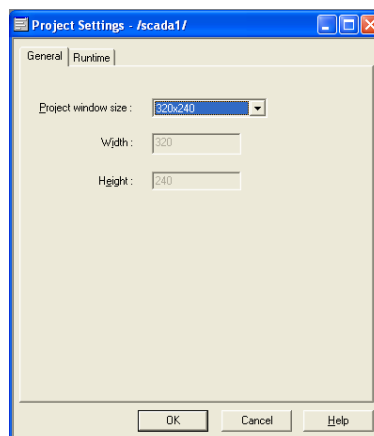


Fig. 3m.9. Project Settings window

4. Prepare correct configuration of Communication. First check available devices. For this purpose click the **Communications** tab (Fig. 3m.10).

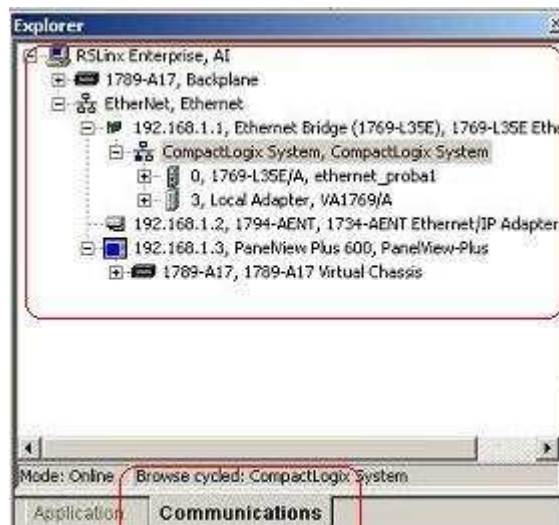


Fig. 3m.10. Communications tab

5. Define the **Local** and **Target** communication path: **Local** is a data source device for testing HMI applications, **Target** is a data source device for the final application. In particular, the Local and Target path can be the same. To define the communication path find *RSLinx Enterprise* > *Communication Setup* bookmark in the project tree (Fig. 3m.11).

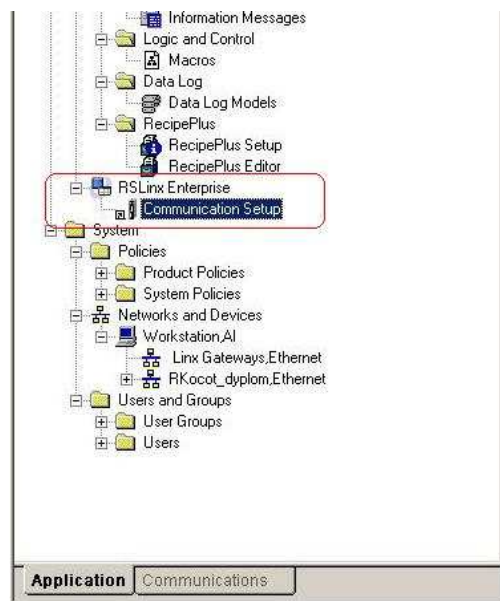


Fig. 3m.11. Communication setup

6. Select **Create a new configuration**, and click the **Finish** button – the window **Communication Setup** will appear (Fig. 3m.12). Select **Local** tab and create new **Device Shortcuts** – **Add** button. As a local source device select the *CompactLogix System*. **Target** configuration we can copy from **Local** setting by using the **Copy** button.

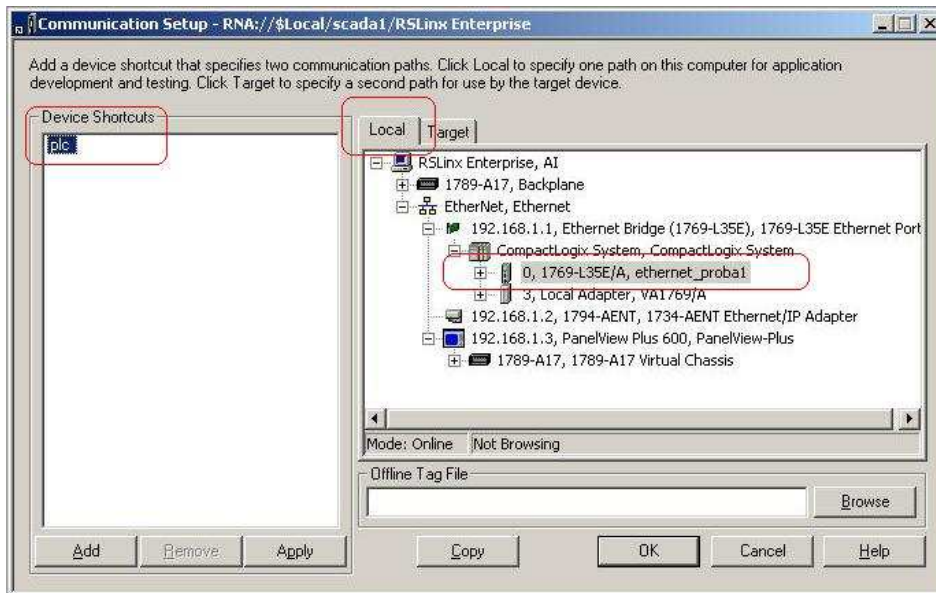


Fig. 3m.12. The Communicaton Setup window

7. To apply the configuration push the **OK** button.

Now we are ready for developing visualization of our process. First prepare a virtual display. *ALARM*, *DIAGNOSTICS* and *INFORMATION* displays are created automatically in the section *Graphics->Displays*. The new displays will be added there. To do this, right-click *Displays* – from the context menu and select *New* (Fig. 3m.13).

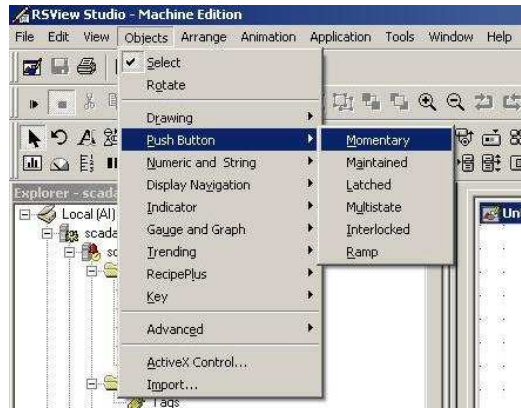


Fig. 3m.13. Adding a new display

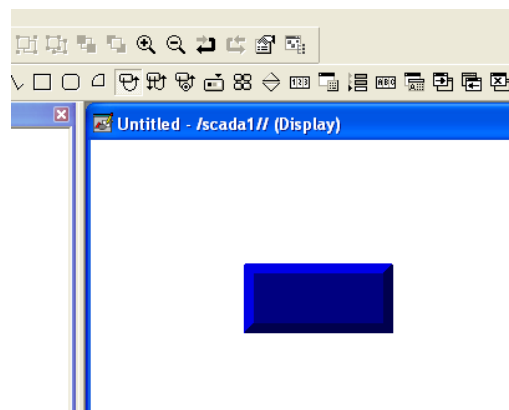
A new empty window with edited display will be opened. We can add several graphic elements to visualize our process. You can find detailed descriptions of the available elements in [2] and [3]

As an example we can create a momentary pushbutton. For this purpose:

1. Select the *Object* *Push Button* *Momentary* item from the menu.

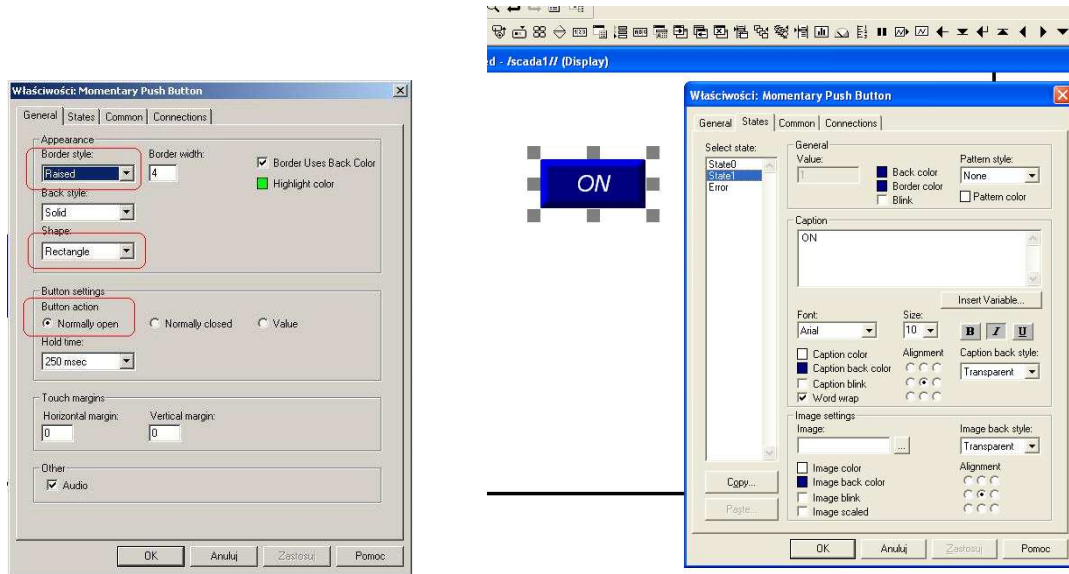


2. Left-click and drag the mouse pointer up to create a rectangle.

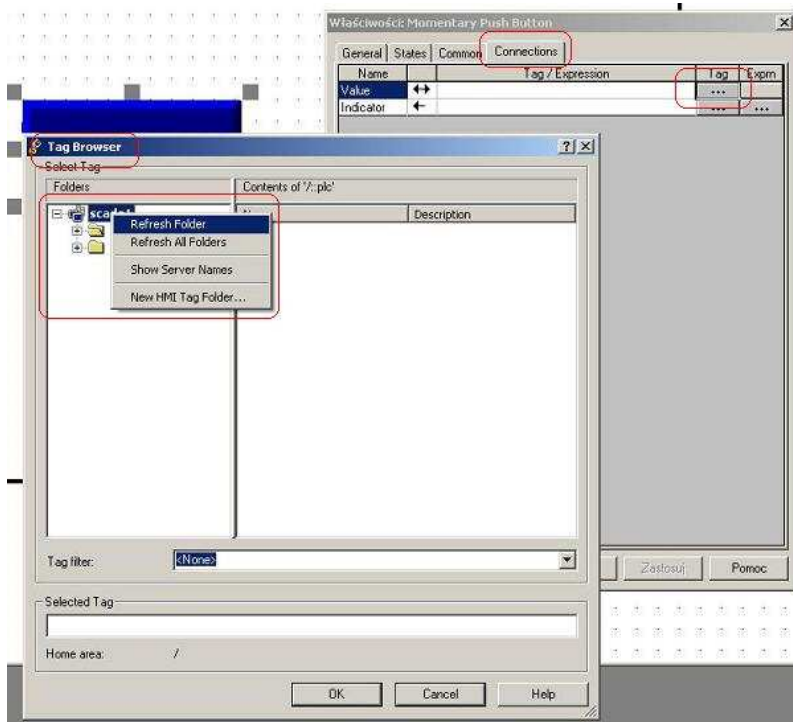


3. Double-click on the rectangle to open the **Properties** window. Set the appropriate parameters such as: appearance, button settings, caption, etc.

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4. Define the corresponding tag. Click the **Connections** tab and browse the data by using **Tag Browser**. Refresh the actual folder – all available network tags will be displayed.



Select the appropriate tag – now the pushbutton will be connected with the tag value.

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Bibliography

- [1] Allen-Bradley. Adjustable Frequency AC Drive FRN 1.xx – 4.xx User Manual. Rockwell Automation, January 2007
- [2] Rockwell Software. RS View Machine Edition. User's Guide vol.1, Rockwell Automation, July 2005
- [3] Rockwell Software. RS View Machine Edition. User's Guide vol.2, Rockwell Automation, July 2005