

# Raspberry PI Support

From D2000 version v12, the installation program is available for the operating system Raspbian for Raspberry PI platform (models 2 and higher) and for computers built on [Raspberry Compute Module](#) (for example, Techbase [NPE X500 M3](#) industrial computer).

A full D2000 system image for Raspberry PI can be for simplification directly downloaded from <https://d2000.ipesoft.com/download/#raspberry> (950 MB, after unzipping 3.5 GB). The image does not contain a graphic interface (to keep the image small), but [it can be installed](#).

To obtain the D2000 installers for Raspberry PI platform and to obtain the images for the [Techbase NPE X500 M3](#) industrial computer, please contact [Ipesoft sales department](#).

Installing and configuring the image for Raspberry PI:

- Download the system image from <https://d2000.ipesoft.com/download/#raspberry> and unzip it.
- Insert a free micro SD card with a size of at least 4GB to the card reader for transfer of the image.
- Using the [Win32DiskImager](#) utility (in the Windows environment) or using the command `dd` (in Linux) copy the image to a micro SD card.

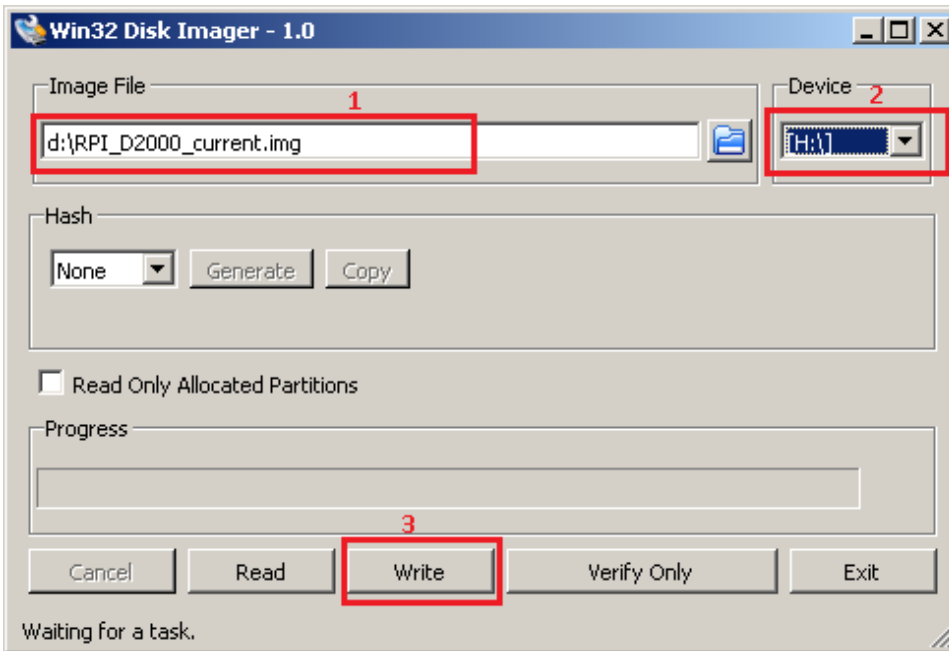


Figure: after running [Win32DiskImager](#), simply select the downloaded image (1), the target micro SD card inserted into the card reader (2) and write the image to the micro SD card with Write button (3).

- Insert the micro SD card into the Raspberry PI and connect the power supply. Raspberry PI boots from the SD card.
- Log in as the default user `pi` with password `raspberry` (for security reasons it is recommended to change the password).
- run a command:  
`sudo raspi-config`  
to start Raspberry Configuration Tool. In the menu, select "7 Advanced Options" and then "A1 Expand Filesystem". Confirm "OK" and select "Finish" from the main menu to exit the tool. Select reboot. Upon reboot, the file system expands so it can use all the free space on the micro SD card.
- after reboot and repeated logging in as a user `pi` identify the IP address and a network mask with a command:  
`ifconfig eth0`  
Example of listing in which the IP address 172.16.0.108 and the network mask 255.255.0.0 can be seen:

```
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 172.16.0.108 netmask 255.255.0.0 broadcast 172.16.255.255
    inet6 fe80::d2bb:4bde:c49a:5f97 prefixlen 64 scopeid 0x20<link>
    ether b8:27:eb:a7:f2:5e txqueuelen 1000 (Ethernet)
    RX packets 5175309 bytes 748932223 (714.2 MiB)
    RX errors 0 dropped 92287 overruns 0 frame 0
    TX packets 1726640 bytes 739692537 (705.4 MiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

Note: If you do not have a DHCP server on the network (or if you want to use a fixed IP address), set the fixed IP address and network mask by editing the `/etc/dhcpd.conf` file.

- To insert the IP address and network mask into the `/opt/d2000/instance.properties` configuration file, edit it with the command:  
`sudo nano /opt/d2000/instance.properties`

Change the IP address in the row

*IPAddr1 = 172.16.0.108*

and mask in the row

*IPMask = 255.255.0.0*

If you have configured a WiFi interface, you can also edit the line with *IpAddr2*.

Save the file with the keyboard shortcut Ctrl+O and exit the editor by pressing Ctrl+X.

- Standard Raspberry PI does not contain a real-time clock (RTC). If your Raspberry PI doesn't have access to preconfigured NTP server (212.82.32.26 t.j. darkstar.sanet.de), then you have to specify a custom NTP server:

*sudo nano /etc/systemd/timesyncd.conf*

Edit the row in the [Time] section with the NTP server IP address and enter IP address of a custom NTP server:

*NTP=212.82.32.26*

Save the file with the keyboard shortcut Ctrl+O and exit the editor by pressing Ctrl+X . Restart the NTP server by the command

*sudo systemctl restart systemd-timesyncd*

Shortly, the *date* command should display the current time.

- Then restart Raspberry PI by command *sudo reboot*
- The installation includes the D2000 with preconfigured application *myapp*. You can log in remotely using [D2000 HI](#), [D2000 CNF](#), [GrEdit](#), [Sysconsole](#), etc. using a default name and password (*SystemD2000/SystemD2000*), which we also recommend to change. When running the tools, it is necessary to specify the parameter **/S<ip\_raspberry>** e.g. */S172.16.0.11*
- After signing in to the [D2000 HI](#), the default scheme S.RPI\_main is automatically opened. The statuses of the configured I/O tags are displayed in the scheme:

I/O tag	BCM pin	Description of configuration and functionality (for identification of BCM pins see <a href="https://pinout.xyz">https://pinout.xyz</a> )
M.RPI_22_DI_UP	22	The pin configured as a digital input with a pull-up resistor (unconnected is 1, after connecting to the ground 0).
M.RPI_23_TRIGGER_UP	23	The pin configured as a counter of signal changes with 100-ms filter with pull-up resistor. The trigger measures number of rising and falling signal edges (0V3.3V and 3.3V 0V).
M.RPI_24_TRIGGER_UP_TOON	24	The pin configured as a counter of rising edges with 100-ms filter with pull-up resistor. The trigger measures number of rising signal edges (0V3.3V).
M.RPI_25_TRIGGER_UP_TOOFF	25	The pin configured as a counter of falling edges with 100-ms filter with pull-up resistor. The trigger measures number of falling signal edges.(3.3V 0V).
M.RPI_26_DO	26	The pin configured as a digital output (values True sets at the output to 3.3 V, value False sets at the output to 0 V).
M.RPI_27_PWM	27	The pin configured as a pulse-impulse output whose width is configurable by writing a value (values 0-255 correspond to 0-100%)
M.RPI_REVISION	-	Returns the value of the hardware revision (number from "Revision" row, from file <i>/proc/cpuinfo</i> ).

The outputs of M.RPI\_26\_DO and M.RPI\_27\_PWM can be controlled (after connecting e.g. LED diodes to respective pins it is possible to see their flashes (pin 26) or change of LED's brightness (pin 27).

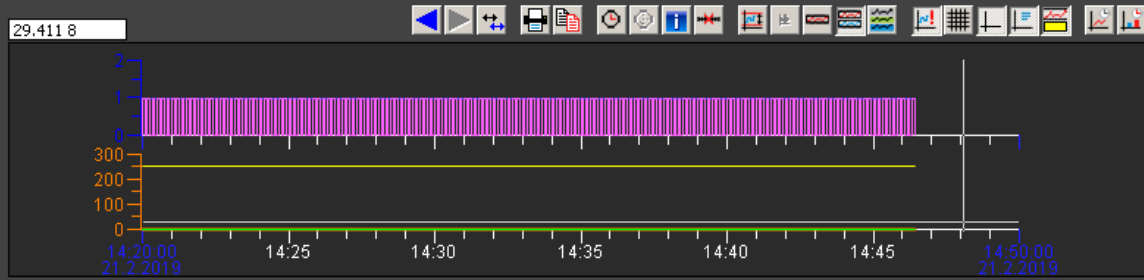
The output M.RPI\_26\_DO is in the automatic mode, it changes every 5 seconds according to the calculated trigger.

The transition between manual and automatic control is possible through the control dialog, which opens after clicking on the top button from two identical buttons labeled "GPIO port 26".

Switching the 0/1 values can also be conveniently done via the lower button.

The M.RPI\_27\_PWM output can be controlled directly by entering a value or by clicking on one of the up/down arrows.

The scheme also shows a chart with time trends of the individual I/O tags that are read from the [D2000 Archiv](#).



Name	Axis	14:48:04 21. 2.	Last value	Units
1. GPIO port 22, digital input with pull-up resistor	0 .. 2	?	1	
1. GPIO port 26, digital output	0 .. 2	?	0	
2. GPIO port 23, trigger for any changes with pull-up resistor	0 .. 300	?	0	
2. GPIO port 24, trigger for changes ToON (0->3.3V) with pull-up resistor	0 .. 300	?	0	
2. GPIO port 25, trigger for changes ToOff (3.3->0V) with pull-up resistor	0 .. 300	?	0	
2. GPIO port 27, pulse - width modulation (0-255)	0 .. 300	?	253	

Revision of RPI hardware

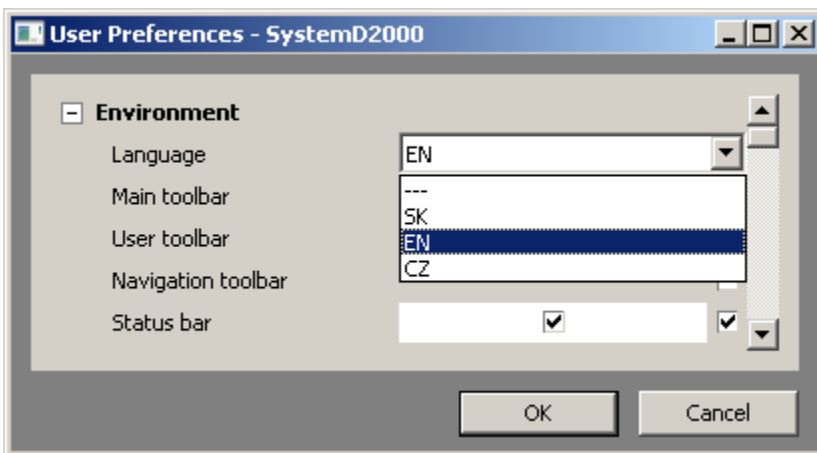
10494163

- GPIO port 22, digital input with pull-up resistor  ON
- GPIO port 23, trigger for any changes with pull-up resistor  0
- GPIO port 24, trigger for changes ToON (0->3.3V) with pull-up resistor  0
- GPIO port 25, trigger for changes ToOff (3.3->0V) with pull-up resistor  0
- GPIO port 27, pulse - width modulation (0-255)

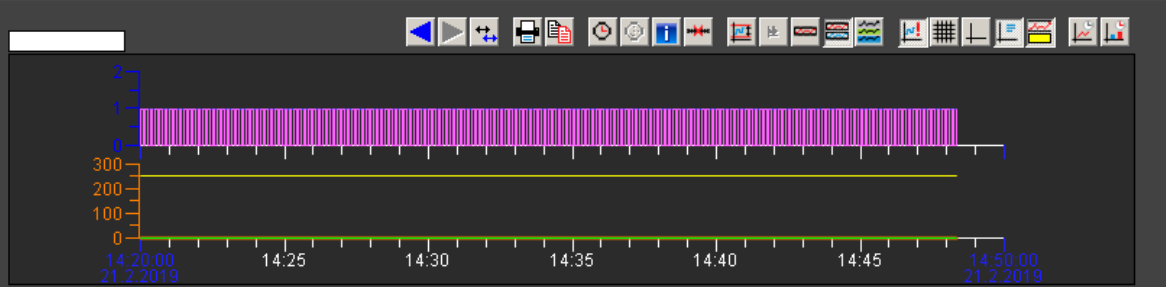
Directly control  
GPIO port 26, digital output  OFF

GPIO port 26, digital output  
Dialog / Automatic control  OFF

The schema is by default displayed in English, in the *System User preferences* menu it is possible to change the language by changing item Language from EN to SK or CZ.



Subsequently, both the interface and schema content are displayed in the selected language:



Názov	Os	Posledná	Jednotky
1. GPIO port 22, digitálny vstup s pull-up odporom	0 .. 2	1	
1. GPIO port 26, digitálny výstup	0 .. 2	1	
2. GPIO port 23, trigger na zmeny s pull-up rezistorom	0 .. 300	0	
2. GPIO port 24, trigger na zmeny ToON (0->3.3V) s pull-up rezistorom	0 .. 300	0	
2. GPIO port 25, trigger na zmeny ToOff (3.3->0V) s pull-up rezistorom	0 .. 300	0	
2. GPIO port 27, pulzne - šírková modulácia (0-255)	0 .. 300	253	

### Revízia hardvéru RPI

10494163

GPIO port 22, digitálny vstup s pull-up odporom

ON

GPIO port 23, trigger na zmeny s pull-up rezistorom

0

GPIO port 24, trigger na zmeny ToON (0-&gt;3.3V) s pull-up rezistorom

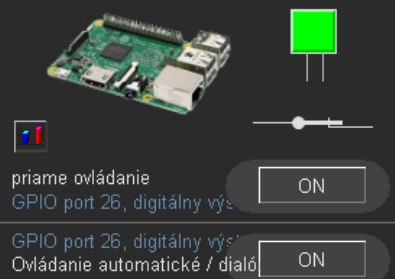
0

GPIO port 25, trigger na zmeny ToOff (3.3-&gt;0V) s pull-up rezistorom

0

GPIO port 27, pulzne - šírková modulácia (0-255)

253

▲  
▼

The D2000 installation does not include a software license key, so it works in DEMO mode (restart every hour). To enable time-unlimited DEMO operation, allow D2000 to send [diagnostic telemetry](#) to Ipesoft. To enable the telemetry, edit this configuration file `/opt/d2000/instance.properties` and set following values:

#### *enable the telemetry*

```
InstanceConfig.DiagCollect.Enabled = 1
```

#### *if you use direct internet connection*

```
InstanceConfig.Proxy.ProxyType = 0
```

#### *if you use proxy*

```
InstanceConfig.Proxy.ProxyType = 2
```

*enter <proxy\_address> and <proxy\_port>*

```
InstanceConfig.Proxy.ProxyAddress = <proxy_address>
```

```
InstanceConfig.Proxy.ProxyPort = <proxy_port>
```

#### *if the proxy server doesn't need authentication*

```
InstanceConfig.Proxy.ProxyAuth = 0
```

*if the proxy server needs authentication*

```
InstanceConfig.Proxy.ProxyAuth = 1
```

*enter <user\_name> and <user\_password>*

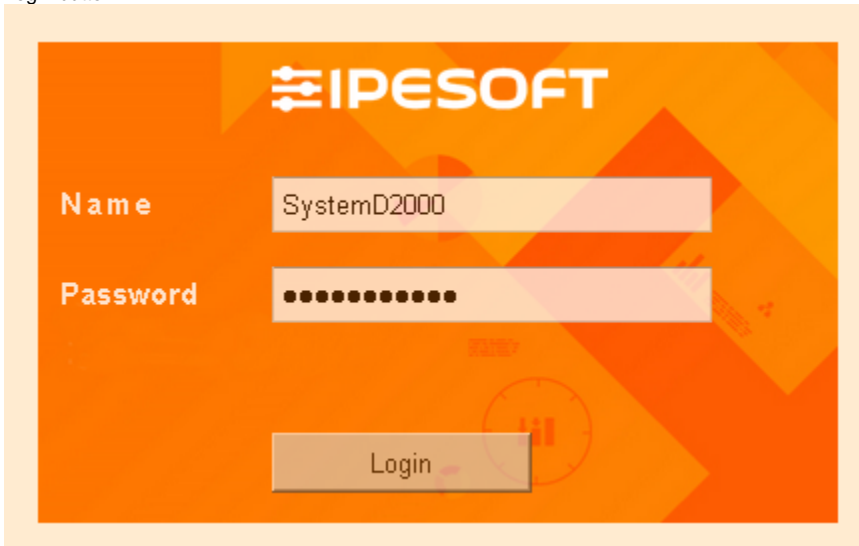
```
InstanceConfig.Proxy.ProxyUser = <user_name>
```

```
InstanceConfig.Proxy.ProxyPassword = <user_password>
```

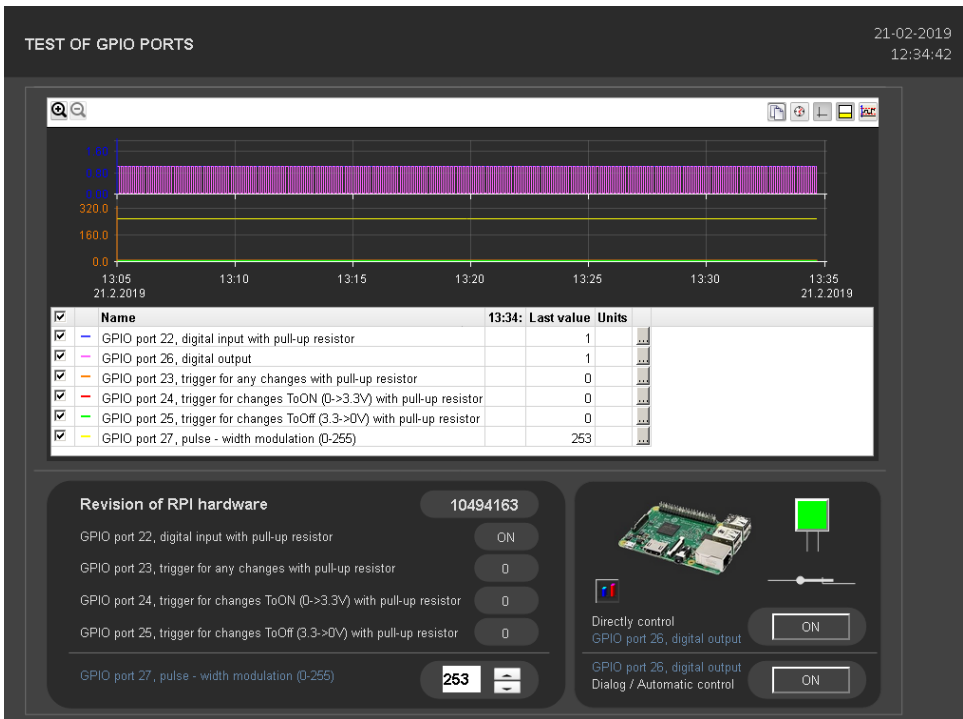
If you are interested in generating a license key, please `run /opt/d2000/bin/hwinfo`. A file named `info_<computername>_yyyy-mm-dd.hwi` (e.g., `info_raspberrypi_2018-09-13.hwi`) will be created, based on which the license can be generated. Then copy the license (**LicenseRun.code** file) to the `/opt/d2000` directory and restart D2000.

#### Additional Notes:

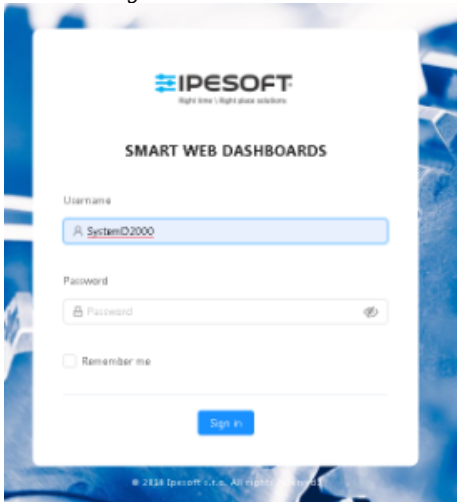
- The *myapp* application also includes the `sqlite.ARC` process that has the autostart disabled. This archive process has an experimental SQLite3 database configured. Standard `SELF.ARC` works with the PostgreSQL database. If the D2000 application was launched as an [XML application](#) that starts from XML files (currently only in read-only mode and without a monitoring database) and the archive would use the SQLite3 database, it would be possible to run a static embedded D2000 application even without a PostgreSQL server.
- All processes with autostart enabled have the startup parameter `/E-CONO.FILE.LOG`, which disables logging into the file (to save the SD card). If necessary, it is possible to delete or modify this parameter. It can be specified also for the kernel in file `/etc/systemd/system/d2000-myapp.service`.
- *Myapp* application is configured with running Java (`openjdk-8-jre` is used). By changing a line `Kernel.UseJava = 1` to `Kernel.UseJava = 0` in file `/opt/d2000/app/myapp/application.properties` and following restart, it is possible to disable Java usage to reduce the memory requirements of the kernel (114 MB 96 MB according to the output of the command `"ps aux -sort -rss"`)
- *Myapp* application also includes a web application (for a thin client) deployed on a web server. The app can be accessed through the web browser at `http://<raspberrypi_ip_address>`. You must enter a standard username and password (SystemD2000:SystemD2000) and click on the Login button:



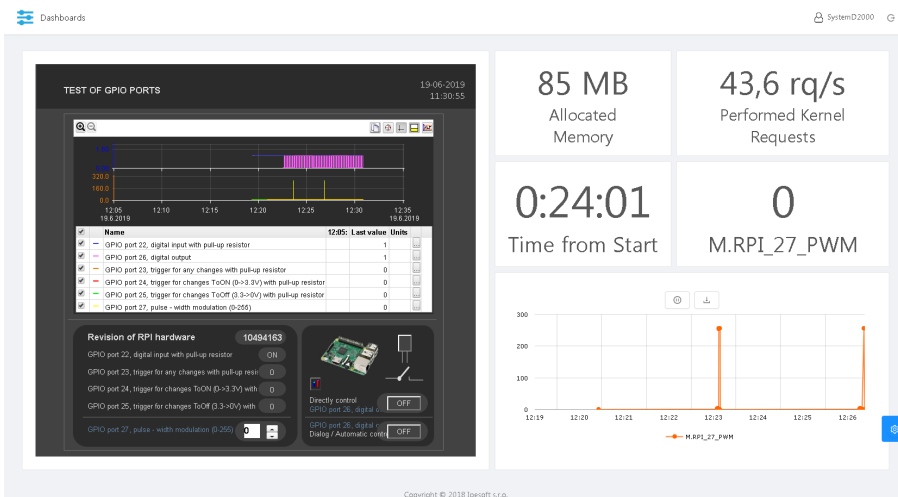
After signing in, the default schema is displayed:



- *Myapp* application also includes a *SmartWeb* dashboard (for a thin client) deployed on a web server. The app can be accessed through the web browser at [http://<raspberrypi\\_ip\\_address>/dashboards](http://<raspberrypi_ip_address>/dashboards). You must enter a standard username and password (SystemD2000:SystemD2000) and click on the *Sign in* button:



After a successful logon a dashboard is displayed. To modify it, click the blue icon in right bottom part of the web page.



- *Myapp* application also includes an OPC UA server - the SELF.OUS process that has the autostart disabled. When it is started, it loads the configuration file

`/opt/d2000/app/myapp/config/proc/self.oua/opcuaserver.conf`

For secure communication, it uses a private key

`/opt/d2000/app/myapp/config/proc/self.oua/pki/private/private.pem`

and a certificate

`/opt/d2000/app/myapp/config/proc/self.oua/pki/own/cert.der`

If the OPC UA client is used to connect the OPC UA client to port 4840 using encryption, the client will be first denied and its certificate will be stored in `/opt/d2000/app/myapp/config/proc/self.oua/pki/rejected` directory.

After moving the certificate to `/opt/d2000/app/myapp/config/proc/self.oua/pki/trusted`, the client will be accepted (restart of OPC UA server is not required).

Client authentication may be either anonymous or a with a user *sample* using a password *sample1* (see definition of *sample\_user* identifier and its use in the *opcuaserver.conf* configuration file).

The *OPCUA\_User\_SELF* user is created in the *myapp* configuration for the OPC UA server. The OPC UA server has the same access rights to application objects as the *OPCUA\_User\_SELF* user (currently, the *Home OPCUA\_User\_SELF* object group defines read-only access to system variables only).

- Raspberry Pi image does not contain a graphic interface (to keep the image small). If required, it can be installed according to the [guide](#). Installing Raspberry Pi Desktop requires:

```
sudo apt-get install --no-install-recommends xserver-xorg
```

```
sudo apt-get install --no-install-recommends xinit
```

```
sudo apt-get install raspberrypi-ui-mods
```

```
sudo apt-get install --no-install-recommends raspberrypi-ui-mods lxterminal gvfs
```

then Google Chrome browser can be installed:

```
sudo apt-get install chromium-browser
```

## Blog

You can read blogs about D2000 and Raspberry PI:

- [D2000 \(aims for\) IoT! What possibilities does it bring?](#)
- [Do you want to build your own SCADA on RPI? GPIO protocol is here to help!](#)
- [How I started up D2000 on a Raspberry PI](#)
- [Moxa NPort or an industrial Raspberry? You choose...](#)
- [Two raspberries are more than one](#)