This manual …

… provides you with all the information which you will require to use the Easylon® USB Socket Interface.

However, this manual will neither explain aspects of Echelon’s® LONWORKS® technology, nor Echelon's Microprocessor Interface Program (MIP) used on this network interface card. The drivers of the USB Socket Interface have been developed in compliance with the driver specifications of the Echelon Corporation. Details of these are as well not described in this documentation. For further information on the LONWORKS technology please refer to the extensive documentation provided by Echelon.

After a general presentation of the Easylon USB Socket Interface in Chapter 1, Chapter 2 describes the necessary steps to install the module.

Chapter 3 gives the technical specifications of the device and Chapter 4 provides some programming instruction for operation under Windows CE. Tips and tricks concerning the operation can be found in Chapter 5.

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The Easylon USB Socket Interface incorporates the MIP program by Echelon Corporation. The aforesaid company holds all rights relating to this software.
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1 Product Information

This manual describes the Easylon USB Socket Interface.

Figure 1-1 Easylon USB Socket Interface\(^1\) FT-X2 and EIA-485

1.1 Variants

The following variants of the Easylon USB Socket Interface are described in this documentation.

<table>
<thead>
<tr>
<th>Order Code</th>
<th>Network Interface Type</th>
<th>Neuron Firmware</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>P.P10503-3</td>
<td>EIA-485</td>
<td>MIP</td>
<td></td>
</tr>
<tr>
<td>P.P20503-3</td>
<td>EIA-485</td>
<td>MIP</td>
<td>extended temperature</td>
</tr>
<tr>
<td>P.P10506-3</td>
<td>FTX</td>
<td>MIP</td>
<td>extended temperature</td>
</tr>
<tr>
<td>P.P20506-3</td>
<td>FTX</td>
<td>MIP</td>
<td>extended temperature</td>
</tr>
</tbody>
</table>

Table 1-1 Variants and order-codes of Easylon USB Socket Interfaces

1.2 Scope of Delivery

- Easylon USB Socket Interface module with Echelon’s MIP firmware
- Technical short information
- Installation and documentation CD with
  - 32/64 bit driver for Windows\(^2\) XP / Vista / 7 / 8 / Server 2003 / 2008 / 2008R2 / 2012
  - Easylon RNI Software for remote LONWORKS access
  - EasyCheck diagnosis utility for Easylon interfaces

---

\(^1\) Modification of connectors on request
\(^2\) A Linux driver is available in source code on demand
1.3 Overview

The Easyelon USB Socket Interface realizes a LON-USB connection as a plug-in module, to be integrated into OEM devices. USB connection to the CPU board is made by a 10pin connector designed according the ASUS standard. Power supply uses this connector as well.

As an OEM module a certain flexibility with respect to customer specific requirements is observed, e.g. with respect to the connector types or positions. The respective module may therefore be different from the description in this documentation.

An Evaluation Kit available to the Easyelon USB Socket Interface allows easy access to connections and signals of the board.

The module is available in different transceiver variants all with MIP firmware. Additionally to the FTX transceiver there is EIA-485. Furthermore there are variants for extended temperature range. Service button and ~LED are implemented.

Note

Due to the usage of the Neuron 5000 with MIP firmware this module is not suited for LNS based applications.

The driver for the Easyelon USB Socket Interface is compliant with Echelon’s driver interface. Applications using the driver interface directly can use the interface without problems. The Easyelon USB Socket Interface is compatible with the Easyelon OPC Server and Gesytec’s WLDV32.DLL.

The Easyelon USB Socket Interface is a so called high speed USB device according to USB standard 2.0, however compatible with USB 1.1. The communication between the Neuron chip and USB is handled by a micro controller. The firmware for this micro controller is downloaded automatically, when the PC is started.

(1) USB connector pin 1, 1/10 inch pitch
(2) Status/error LED (green/red)
(3) Service LED (yellow)
(4) Service pin push button
(5) GND connector
(6) LonWorks connector pin 1

Figure 1-2 Module components shown for FTX variant
Service LED

The service LED (Figure 1-2, (3)) signals the card status. The following signals are defined the service LED:

<table>
<thead>
<tr>
<th>Service LED</th>
<th>Status</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flash (1 Hz)</td>
<td>No Neuron communication</td>
<td>Error</td>
</tr>
<tr>
<td>Blink (1/2 Hz)</td>
<td>Driver installed, node is “unconfigured”³</td>
<td>Configure the node.</td>
</tr>
<tr>
<td>Permanently ON</td>
<td>Node is „applicationless“ and „unconfigured“.</td>
<td></td>
</tr>
<tr>
<td>Permanently OFF</td>
<td>Installation ok or USB not connected or driver not loaded</td>
<td>Normal operation check USB side check Windows device manager for driver</td>
</tr>
</tbody>
</table>

Table 1-2 Service LED

³ device is delivered “unconfigured”
2 Installation

Please check the delivered items. You must find the Easylon USB Socket Interface and an installation CD, containing drivers and this documentation.

2.1 Hardware Installation

Please refer also to the manual describing the device into which you want to insert the Easylon USB Socket Interface. Turn off power, open the device and plug the USB module into a suitable USB socket. Please observer the following chapter “Pin Assignment”. Restart the PC after the module has been installed and insert the Drivers & Documentation CD in order to get the appropriate driver (cf. chapter 2.2 Driver Installation).

2.1.1 Pin Assignment

<table>
<thead>
<tr>
<th>PIN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+5 Volt</td>
</tr>
<tr>
<td>2</td>
<td>+5 Volt</td>
</tr>
<tr>
<td>3</td>
<td>USB -</td>
</tr>
<tr>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>USB +</td>
</tr>
<tr>
<td>6</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>GND</td>
</tr>
<tr>
<td>8</td>
<td>GND</td>
</tr>
<tr>
<td>9</td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 2-1 Pin assignment of 10 pin USB connector

<table>
<thead>
<tr>
<th>PIN</th>
<th>MNEMO</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RT +</td>
<td>LON data +</td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
<td>ground</td>
</tr>
<tr>
<td>3</td>
<td>RT -</td>
<td>LON data –</td>
</tr>
</tbody>
</table>

Table 2-2 Pin assignment of 3pin LON connector

Pin 1 position cf. Figure 1-2
2.2 Driver Installation

Drivers for different operating systems are available for the Easylon USB Socket Interface. Currently these are Windows 2000, XP, Vista, 7 and 8 and the Windows Server OS 2003, 2008, 2008 R2 and 2012. The drivers support both, the 32 and the 64 bit version of these operating systems. Latest driver versions you can download via the Easylon Support pages of our web site: www.gesytec.com.

A Linux driver is available in source code on request.

Installation for different operating systems is described in the following sections.

<table>
<thead>
<tr>
<th>Operating System</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows operating systems</td>
<td>section 2.2.1</td>
</tr>
<tr>
<td>Windows CE</td>
<td>section 2.2.4</td>
</tr>
<tr>
<td>16-Bit driver under 32-bit Windows</td>
<td>section 2.2.2</td>
</tr>
</tbody>
</table>

This section also describes in short the diagnosis utility „EasyCheck“ which can be installed separately from CD.

2.2.1 Driver for Windows Operating System (WDM Drivers)

This section describes installation and setup of the Easylon Interface card drivers for the Windows operating system from XP onwards.

The setup program is using the same WDM driver (Windows Driver Model) for all operating systems.

Note:

For installation you can either use the Windows assistant or the program FastUpd.exe for manual installation, which is much more straightforward (cf. chapter 2.2.1.2).

The latter is especially helpful if you are running Windows 7 and later or have to install several instances of the driver.

2.2.1.1 Installation using the Windows Assistant

After the Easylon Interface has been mounted Windows will recognize the new device and start the hardware assistant.

If Windows should not find the driver on the “Drivers and Documentation” CD or the driver should be elsewhere, please select the appropriate drive and select the setup file “lonusb.inf” and the driver “Gesytec LONUSB FX2 Driver” from the “LonUsb“ directory.
Windows 7

Windows 7 systems directly start looking for a driver at Windows Update and therefore ignore the CD. Consequently the installation using the assistant will fail and manual settings are required.

You can either follow the steps described in 2.2.1.2 “Manual Installation and Update” or proceed as follows:

Open the Device Manager (e.g. via the control panel).

Right click on the entry for the unknown device and select “Update Drivers”.

Select “Browse my computer ….” and indicate the drive with the “Drivers & Documentation” CD. Finally give permission for the Gesytec driver setup.

Final Steps

After successful completion of the installation the device manager will show the interface under „LON Adapters“.
Here you will find a „Gesytec LONUSB x-y...“ entry, with x designating the number of the USB host controller and y the port. If external hubs have been cascaded the respective port numbers are given as well.

If, after the installation the green LED does not blink an error has occurred in the Easylon USB Socket Interface installation. In that case, please restart the PC.

During the installation and at each Neuron reset the red LED is shortly flashing.

The device is now ready to access the LONWORKS network.

2.2.1.2 Manual Installation and Update

The easiest way to install the driver is to ignore the hardware assistant and run FastUpd.exe from the “Driver/LonUsb” folder of the CD-ROM.

If the “Drivers & Documentation” CD interface has opened in your browser you may access the driver setup as well via “Products” “Easylon USB Socket Interface” and selecting the button for the operating system.

The same program you will use to update an existing driver.

A new version will be installed on the PC within a few seconds. In order to update the firmware in the device as well, you must disconnect the USB Socket Interface and reconnect it again.

2.2.1.3 Settings

There are further settings available for the Easylon USB Socket Interface which may be helpful in certain operating conditions. They can be found in the Universal Serial Bus Controller section of the device manager. Select the properties of the desired device.
The „Advanced Properties“ offer the following settings:

**Lon Adapter**
This will assign a name „LON1“ ... „LON9“ to the LON USB adapter, which certain application will require. Remember that the name must not be in use by any other device driver. In case of a name conflict the device cannot be started. (Code 10).

**Adapter Name**
Alternatively an arbitrary name can be assigned to the adapter (e.g. floor 7). If both „Lon Adapter“ and „Adapter Name“ are assigned to the same device only the entry for „Lon Adapter“ will be used.

**Debug Flag**
The value comprises a DWORD in hexadecimal notation of different flags for debug purposes. Usually it is set to 0 (not existing). Setting the single bits will
turn on special debug features. In the current driver versions bits 0, 1 and 3 are used.

Bit 0: LON telegrams at the interface from and to the application are shown in debug output.

Bit 1: LON telegrams at the interface from and to the USB bus are shown in debug output.

Bit 3: CREATE and CLOSE) of the driver are displayed in the debug output.

Note The debug output for instance can be displayed using the DebugView program, which is freely available at www.sysinternals.com.

Permitted Power Saving
Usually the LON USB adapter allows a standby mode with applications running (Standby). At certain conditions however, (e.g. LON USB using an external hub under Windows 2000) the current supply to the LON USB adapter will be short-ly interrupted during return from the standby mode by the external hub. Under such conditions a standby mode must be turned off (None).

2.2.2 Windows and 16 Bit Applications

The Windows driver for the 32 bit Windows versions also provides a 16 bit inter-
face. (Unfortunately Microsoft does not support this in the 64 bit versions.) To use it, the following entry has to be made in the file „config.nt“, usually found in
the windows\system32 directory:

```
Device=%SystemRoot%\system32\lpdos.exe –Llonusb1-2
```

The 32 bit LON device used is specified by the optional –L or /L parameter:

```
/Lname

name =

lonusb1-2 for device LONUSB at USB host controller 1 and with port number 2 at USB root. If several hubs have been cascaded the respective port numbers have to be provided as well.
```

Note: Two subsequent “l” characters have to be entered, one indicating the parameter -L, the second as first character of the name: –Llxxxx

The 16 bit LON device used is specified by the following optional parameter:

```
/Dn

with n = 1...9 for LON1 to LON9
```
Without this parameter, the interface will be assigned the first unused name starting with “LON1”.

### 2.2.3 EasyCheck – Quick Interface Diagnosis

In addition to the drivers, the test utility “EasyCheck” can be installed in the respective program directory (default: \Easylon\Lpx). The program checks interface and software environment and displays information, from which can be concluded on the reasons for problems in connection with the interface.

The program “EasyCheck” runs an analysis of the system’s software. It will open the selected interface, check the driver version and display it. By sending a “query status” command the communication with the hardware is tested. Using the “read memory” command the utility will show if the device is running MIP or NSI firmware. Properly installed Easylon Interfaces will send a corresponding answer.

### 2.2.4 Windows CE Driver

The Windows CE driver has been designed for x86 processors. Variants for other processors can be realized on request. There are versions for Windows up to CE 6.0.

**Note:** Prior to using the interface please check if your Windows CE system supports USB. For instance you could connect a standard USB device like mouse, keyboard or memory stick.

The Windows CE driver comes is a DLL named lonusb.dll. Like all Windows CE drivers it must be in the Windows directory of your system. The required files can be found on the Driver & Documentation CD under Drivers/Windows CE/xx/LonUsb.

If the driver has to be integrated into the Windows CE image, the simplest way is a respective entry in the platform.bib file. This approach is almost the same for all Windows CE versions.

For correct operation he driver requires registry entries. These can be found in the file lonusb.reg. In order to integrate the driver into a Windows CE image, the contents of this file has to be copied into the file platform.reg.

```plaintext
; LONUSB - Driver
[HKEY_LOCAL_MACHINE\Drivers\USB\LoadClients\3596\Default\Default\LonUsb]
    "DLL"="lonusb.dll"
    "Prefix"="LON"
    "DebugFlag"=dword:0
    "ReadTimeout"=dword:FFFFFFFF
```
3 Technical Specifications

CPU
EIA-485 version Neuron 5000,
FTX version Neuron FT5000

Clock
80 MHz

USB Interface
Type
USB slave interface accord. to high speed USB standard 2.0

Connector
10 pin 2 row edge connector

LONWORKS Interface
Transceiver
FT-X2, electrically isolated
EIA-485, not electrically isolated, 1.25 Mbps max.

Connector
3 pin edge connector

Power Supply
Power Supply
5 V DC +/-10%, externally via USB connector

Power Consumption
< 100 mA, typically

Operating Conditions
Temperature
Operation
0 °C – +70 °C
-40 °C – +85 °C
Storage
-40 °C – +85 °C
Humidity
90%, no condensation

Display and Operation
Neuron service push button
Neuron service LED (yellow)
status LED (green)
error LED (red)
Dimensions

Board 69.34 x 36.96 [mm]

Figure 3-1  Dimensions FTX version

Figure 3-2  Dimensions EIA-485 version
4 Programming Instructions

4.1 Windows CE Application Interface

Note: Some of the functions described below are marked “obsolete”. These functions and control codes are referenced here only for compatibility with older versions of LPCDRV/LG2DRV and should not be used for development of new software.

4.1.1 CreateFile

Opens a LON device.

Syntax:
```
ni_handle = CreateFile(szDevName, GENERIC_READ|GENERIC_WRITE, 0, NULL, OPEN_EXISTING, 0, NULL);
```

Parameter Type Description
--- --- ---
SzDevName TCHAR* Device name, e.g. TEXT("LON1:"
Return value Type Description
ni_handle HANDLE file handle of the LON device or INVALID_HANDLE_VALUE

4.1.2 CloseHandle

Closes a LON device.

Syntax:
```
CloseHandle(ni_handle);
```

Parameter Type Description
--- --- ---
ni_handle HANDLE file handle of the LON device that should be closed

4.1.3 ReadFile

This synchronous function reads a telegram according to the application layer format. Synchronous means the function returns only if the NEURON received the telegram or the handle is closed.

The timeout of this blocking call can be changed via registry or via DeviceIoControl. A timeout value of 0 means, that this function returns immediately, if no data are available.

Syntax:
```
ReadFile(ni_handle, pMsg, len, &rLen, NULL);
```
Parameter | Type    | Description                           
---        | ---     | ---                                   

| ni_handle | HANDLE  | file handle of the LON device         
| pMsg      | void*   | pointer to an „explicit message buffer“ 
| len       | DWORD   | length of the buffer [bytes]          
| rlen      | DWORD   | length of the received telegram [bytes] 

4.1.4 WriteFile

Writes a telegram according to the application layer format. This function returns immediately.

Syntax:

```c
WriteFile(ni_handle, pMsg, len, &rLen, NULL);
```

Parameter | Type    | Description                           
---        | ---     | ---                                   

| ni_handle | HANDLE  | file handle of the LON device         
| pMsg      | void*   | pointer to an „explicit message buffer“ 
| len       | DWORD   | length of the buffer [bytes]          
| rlen      | DWORD   | length of the telegram to be send [bytes] 

Note: The telegram according to the application layer format contains a length information of the buffer itself. That is why we ignore the parameter len in the use of function ReadFile() and WriteFile(). Note: Use the maximum length (256 bytes) of the buffer while reading a telegram.

4.1.5 GetVersion

Returns the version number of the driver as Unicode string, e.g.

```
TEXT("Easylon LonUsb Version 1.00 for WinCE from 11/05/2002").
```

Syntax:

```c
#define IOCTL_LPCDRV_GET_VERSION \
    CTL_CODE( FILE_DEVICE_LPCDRV, 0x900, \
    METHOD_BUFFERED, FILE_READ_ACCESS )

#define IOCTL_GETVERSION 0x43504C01 //obsolete

result = DeviceIoControl(ni_handle, 
    IOCTL_LPCDRV_GET_VERSION, 
    NULL, 0, szVersion, sizeof(szVersion), 
    BytesReturned, NULL);
```

Parameter | Type    | Description                           
---        | ---     | ---                                   

| ni_handle | HANDLE  | file handle of the LON device         
| szVersion | TCHAR*  | Buffer for version string             
| BytesReturned | DWORD | length of the string [bytes] 

Return value | Type    | Description                           
---            | ---     | ---                                   

Result | BOOL | FALSE if buffer is too small, else TRUE
4.1.6 ReadFile with Timeout

Reads a telegram according to the application layer format. The Timeout parameter determines the functions behavior while the receive buffer is empty:

Timeout = 0: function returns immediately
Timeout = n: function waits n milliseconds to receive a telegram.
Timeout = INFINITE: function works as synchronous function, see also function ReadFile.

Syntax:
```
#define IOCTL_LPCDRV_READ_WAIT
   CTL_CODE( FILE_DEVICE_LPCDRV, 0x908, \ 
            METHOD_BUFFERED, (FILE_READ_DATA | FILE_WRITE_DATA) )
result = DeviceIoControl(ni_handle, IOCTL_LPCDRV_READ_WAIT, 
    &timeout, 4, pMsg, len, 
    &rLen, NULL);
```

```
#define IOCTL_READ0x43504C02 // obsolete
result = DeviceIoControl(ni_handle, IOCTL_READ, 
    pMsg, len, &timeout, 4, 
    &rLen, NULL);
```

Note: Using IOCTL_READ the Parameters lpInBuffer and lpOutBuffer as well as nInBufferSize and nOutBufferSize are permuted as defined in the API Reference of DeviceIoControl.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ni_handle</td>
<td>HANDLE</td>
<td>file handle of the LON device</td>
</tr>
<tr>
<td>timeout</td>
<td>DWORD</td>
<td>Timeout [Milliseconds]</td>
</tr>
<tr>
<td>pMsg</td>
<td>void*</td>
<td>pointer to an „explicit message buffer“</td>
</tr>
<tr>
<td>len</td>
<td>DWORD</td>
<td>length of the buffers [bytes]</td>
</tr>
</tbody>
</table>

Return value Type Description
Result BOOL TRUE, if telegram was received
FALSE at timeout

4.1.7 Set Timeout for ReadFile

Reads a telegram according to the application layer format. The Timeout parameter determines the functions behavior while the receive buffer is empty:

Timeout = 0: function returns immediately
Timeout = n: function waits n milliseconds to receive a telegram.
Timeout = INFINITE: function works as synchronous function, see also function ReadFile.

Syntax:
```
#define IOCTL_LPCDRV_SET_READ_TIMEOUT
   CTL_CODE( FILE_DEVICE_LPCDRV, 0x909, \ 
            METHOD_BUFFERED, FILE_WRITE_DATA) 
```
result = DeviceIoControl(ni_handle, IOCTL_LPCDRV_READ_WAIT, 
    &timeout, 4, NULL, 0, 
    &rLen, NULL);

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ni_handle</td>
<td>HANDLE</td>
<td>file handle of the LON device</td>
</tr>
<tr>
<td>timeout</td>
<td>DWORD</td>
<td>Timeout [Milliseconds]</td>
</tr>
<tr>
<td>Return value</td>
<td>Type</td>
<td>Description</td>
</tr>
<tr>
<td>Result</td>
<td>BOOL</td>
<td>TRUE, if timeout was stored, FALSE if an error has occurred</td>
</tr>
</tbody>
</table>

Note: Undefined IOCTL-Codes will return FALSE and set LastError to ERROR_NOT_SUPPORTED.

4.1.8 Registry entries for Easylon USB Interface

; LONUSB - Driver
[HKEY_LOCAL_MACHINE\Drivers\USB\LoadClients\3596\Default\Default\LonUsb]
  "DLL"="lonusb.dll"
  "Prefix"="LON"
  "DebugFlag"=dword:0
  "ReadTimeout"=dword:FFFFFFFF

DebugFlag

The value comprises a DWORD in hexadecimal notation of different flags for debug purposes. Usually it is set to 0 (not existing). Setting the single bits will turn on special debug features. In the current driver versions bits 0 and 1 are used.

Bit 0: LON telegrams at the interface from and to the application are shown in debug output.

Bit 1: LON telegrams at the interface from and to the USB bus are shown in debug output.

ReadTimeout

The value (in milliseconds) comprises a DWORD in hexadecimal notation to affect the behavior of ReadFile().

A value of INFINITE (= 0xffffffff) makes ReadFile() a blocking call. This is the default behavior, if no parameter is given (like lpcdrv, lg2drv).

A timeout value of 0 means, that this function returns immediately, if no data are available.
5 Tips and Tricks

5.1 Hot Plugging

The Easylon USB Socket Interface may be connected and disconnected, when the PC is already running. Windows recognizes plugging the device in and starts the driver automatically. You should not remove the device, when an application is using it.

5.2 Using an USB Hub

Of course the Easylon USB Socket Interface can be used with an USB hub. If there are a couple of USB devices active, the communication between PC and Easylon USB Socket Interface may be slowed down.

5.3 Standby Mode of PC

A PC with connected Easylon USB Socket Interface may be set to standby mode, because the device will be powered during standby. However, if the device is used with an external USB hub under Windows 2000, it was observed that, at returning from the standby mode, some hubs shortly interrupt the power supply to the Easylon USB Interface. This USB hub behavior will reinitialize the device and active applications, using the Easylon USB Socket Interface before entering standby mode, are not able to communicate with device any longer.

In such configurations please refer to section Settings and set “Permitted Power Saving” to “None” to disable the standby mode. The LON USB driver will then inhibit the standby mode with applications running.

5.4 Hibernation Mode of PC

The Easylon USB Socket Interface does not support the hibernation mode. When the PC enters hibernation mode, the USB will not be powered any longer. As this would lead to a loss of the Neuron Chip settings the LON USB driver will inhibit Windows from turning into the hibernation mode with applications running.
5.5 Registry Key

The driver of the Easylon USB Socket Interface makes an entry in the registry database for each found device, according to Echelon’s guidelines. You will find this entry at:

\HKEY_LOCAL_MACHINE\Software\LonWorks\DeviceDrivers.

For each Easylon USB Socket Interface you will find a key with the device name (Gesytec LONUSBx-y...) and a character value with the driver name.
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