



OVERCURRENT RELAY

ECOFIT 50/51



Technical Manual

(ECOFIT50_51/EN M v1.0)

(7th September 2017)

Schneider
Electric

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1. SAFETY SECTION

1.1 IMPORTANT INFORMATION

NOTICE

This guide and the relevant equipment documentation provide information on handling, commissioning and testing of this equipment.

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, service or maintain it. The following special messages may appear throughout this documentation or on the equipment to indicate 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 a hazardous situation, which, if not avoided, **will result in** death or serious injury.

WARNING

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

CAUTION

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

NOTICE

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

PLEASE NOTE

Electrical equipment must 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, installation, and operation of electrical equipment and has received electrical risk & hazard training to recognize and avoid the hazards involved.

1.2 BEFORE YOU BEGIN



The information in the Safety Section of the equipment documentation is intended to guide users on how to properly install and handle the equipment in order to maintain it in an optimal condition.

It is assumed that everyone who will be associated with the equipment will be familiar with the contents of this Safety section.

When electrical equipment is in operation, hazardous voltages will be present in certain parts of the equipment. Miss observation of notices, incorrect use, or improper use may endanger personnel and equipment, and cause personal injury or physical damage.

The equipment documentation gives instructions for its installation, commissioning, and operation. However, the manual cannot cover all conceivable circumstances or include detailed information on all topics. In the event of questions, please contact the appropriate Schneider Electric technical sales office and request the necessary information before taking any actions.

The following symbols, which may be used on the equipment or referred to in the equipment documentation, must be understood before the equipment is installed or commissioned.

	
Protective Conductor (Ground) terminal.	Functional/Protective Conductor (Ground) terminal.
	Note: This symbol may also be used for a Protective Conductor (Ground) terminal if that terminal is part of a terminal block or sub-assembly e.g. power supply.

1.3 SAFETY INSTRUCTIONS

Read and understand these instructions before performing any procedure with this device.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Only appropriately trained persons who are familiar with and understand the contents of this manual and all other pertinent product documentation and who have received safety training to recognize and avoid hazards involved are authorized to work on and with this device. Installation, adjustment, repair and maintenance must be performed by qualified personnel.
- Before carrying out any work on the equipment, the user must be familiar with the contents of the safety section of this manual, and the ratings on the equipment rating label.
- While handling, commissioning, or testing this equipment, apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- Before performing any commissioning, de-commissioning, or maintenance job on this product:
 - Open breakers and switches, and disconnect all power
 - Power up the relay from USB port, and check the current metering to make sure that there is no current into the relay, even if the indications on front plate are off
 - Use a properly rated voltage sensing device to confirm that power is off.
 - Use lock out and tag out equipment to ensure the power remains off during the job.
 - Make sure that the grounding terminal is connected to the ground during and after the job (where applicable).
- Insulation testing may leave capacitors charged up to a hazardous voltage. At the end of each part of the test, the voltage must be gradually reduced to zero, to discharge capacitors, before the test leads are disconnected.
- Always keep the case cover closed, including before installation and after de-commissioning.
- Do not install this product in ATEX class 0, 1, or 2 areas.

Failure to follow these instructions will result in death or serious injury.

DANGER

UNINTENDED EQUIPMENT OPERATION

- The equipment documentation must be consulted before installing, commissioning, or servicing the equipment.
- If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Failure to follow these instructions will result in death or serious injury.

WARNING

LOSS OF PROTECTION

- The device needs to be fully tested for proper operation after commissioning.
- Observe all accident prevention regulations and local safety guidelines.
- Reference must be made to the external connection diagram before the equipment is installed, commissioned or serviced.

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

⚠ CAUTION**PRODUCT DROP / FOOT INJURY**

- After installation, make sure that the relay is completely plugged and locked into the case / housing, and all the cover screws are tightened.

Failure to follow these instructions can result in injury.

NOTICE**PRODUCT DAMAGE DUE TO MISHANDLING**

- Electronic parts may be damaged if suitable electrostatic voltage discharge (ESD) precautions are not taken.
- Before energizing the equipment, the following must be checked:
 - Voltage rating (rating label/equipment documentation),
 - CT circuit rating (rating label) and integrity of connections,
 - Integrity of the protective conductor (ground) connection (where applicable),
 - Voltage and current rating of external wiring, applicable to the application.

Failure to follow these instructions can result in equipment damage.

1.4 CURRENT TRANSFORMER CIRCUITS**⚠ ⚠ DANGER****HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- Do not open the secondary circuit of a live CT since the high voltage produced may be lethal to personnel and could damage insulation.
- The secondary of the line CT must be shorted before opening any connections to it.

Failure to follow these instructions will result in death or serious injury.

For most equipment with ring-terminal connections, the threaded terminal block for current transformer termination has automatic CT shorting on removal of the module. Therefore, external shorting of the CTs may not be required; the equipment documentation must be checked to see if this applies.

For equipment with pin-terminal connections, the threaded terminal block for current transformer termination does NOT have automatic CT shorting on removal of the module.

1.5 DE-COMMISSIONING AND DISPOSAL**⚠ ⚠ DANGER****HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

Keep the relay housing covered after de-commissioning.

Failure to follow these instructions will result in death or serious injury.

It is recommended that incineration and disposal to water courses is avoided. The equipment must be disposed of with an appropriate manner. Batteries must be removed from any equipment before its disposal, taking precautions to avoid short circuits. Particular regulations within the country of operation, may apply to the disposal of the equipment.

2. INTRODUCTION

2.1 INTRODUCTION TO ECOFIT 50/51

ECOFIT 50/51 is a numerical overcurrent protection relay. It has been designed to offer a cost-effective and plug & play solution in retrofitting General Electric IAC and DIAC, and Basler BE1 relays. The ECOFIT 50/51 relay provides 31 overcurrent curves as well as instantaneous overcurrent protection, to cover a variant range of applications. Along with numerical technology, ECOFIT 50/51 offers events and disturbance recording, and circuit breaker diagnostics. This CT-powered relay is offered in two models for 1 A and 5 A CTs.

Table 2-1: Compatibility table for GE IAC model numbers

IAC model number	Curve type
12IAC51AxxxA	Inverse
12IAC51BxxxA	Inverse with Instantaneous
12IAC53AxxxA	Very Inverse
12IAC53BxxxA	Very Inverse with Instantaneous
12IAC55AxxxA	Short Time
12IAC55BxxxA	Short Time with Instantaneous
12IAC66AxxxA	Long Time
12IAC66BxxxA	Long Time with Instantaneous
12IAC77AxxxA	Extremely Inverse
12IAC77BxxxA	Extremely Inverse with Instantaneous

Table 2-2: Compatibility table for GE DIAC model numbers

DIAC model number	Curve type
DIACA1x	Inverse, Very Inverse, Short time, Long Time, Extremely Inverse and Instantaneous
DIACA5x	

Table 2-3: Compatibility table for Basler BE1-50/51B model numbers

Basler BE1-50/51B model number	Curve type
BE1-50/51B-102, 202	Inverse, Very Inverse, Short time, Long Time, Extremely Inverse and Instantaneous
BE1-50/51B-103, 203	
BE1-50/51B-106, 206	
BE1-50/51B-107, 207	
BE1-50/51B-214	
BE1-50/51B-225	

2.2 ECOFIT 50/51 FEATURES

ECOFIT 50/51 offers a wide range of pickup setting and overcurrent curves, which allows maintaining the existing coordination on the old relays. The relay also provides an integrating reset function to simulate the disk reset characteristic of electromechanical relays.

Below is a detailed features list of ECOFIT 50/51:

- Independent time and Instantaneous elements
- 3 x overcurrent stages (TIME, TIMEBak and INST)
 - Two independent 50/51 O/C elements (TIME and TIMEBak)
 - One 50 O/C element (INST)
- Available in 5 Amp or 1 Amp CT secondary versions
- 31 built in protection curves (DT, IAC51, IAC53, IAC55, IAC66, IAC77, I1, I2, V1, V2, S1, S2, L1, L2, E1, E2, CO-2, CO-5, CO-7, CO-8, CO-9, CO-11, U1, U2, U3, U4, U5, IEEE MI, IEEE VI, IEEE EI, Overload)
- LCD display (16-character by 2-line alphanumeric)
- Disturbance recording (10 records, each 4s max.)
- Overcurrent Fault recording (20 records)
- Event logs (200 events)
- Manual trip mode with Manual Trip pushbuttons and status LED
- Active LED to indicate relay health
- Disk and INST reset characteristics
- Measured current display in primary or secondary values

Inrush blocking based on 2nd harmonic calculation

CB diagnostics (\sum Trips, \sum Ampsⁿ) with indications

- Two magnetically-latched trip flags
- Five configurable LEDs
- USB configuration port and password protection

2.3 ECOFIT 50/51 BENEFITS

ECOFIT 50/51 overcurrent relay provides a wide variety of benefits in retrofit applications, including:

- Plug & play design minimizes commissioning time and help to prevent any wiring change on site
- Self-powered relay requires no battery or auxiliary power (Reduced maintenance)
- Its numerical design drastically reduces testing requirements compared to electro-mechanical relays
- Multi-vendor curves allow retrofitting a variety of legacy relays
- No impact on existing coordination study, thanks to provided legacy relays' curves
- Disturbance records, overcurrent fault records and event logs allow overcurrent fault analysis
- Large setting range allows replacement for both phase and ground overcurrent relays
- Additional TIMEBak element can be used as a backup Time Overcurrent (TOC) stage or as a more sensitive Instantaneous Overcurrent (IOC) element
- CB diagnostics can be preloaded with historical data

3. GETTING STARTED

3.1 RELAY PRESENTATION

Front panel controls and indicators of ECOFIT 50/51 relay are shown in Figure 3-1. All elements are explained in details in Table 3-1.

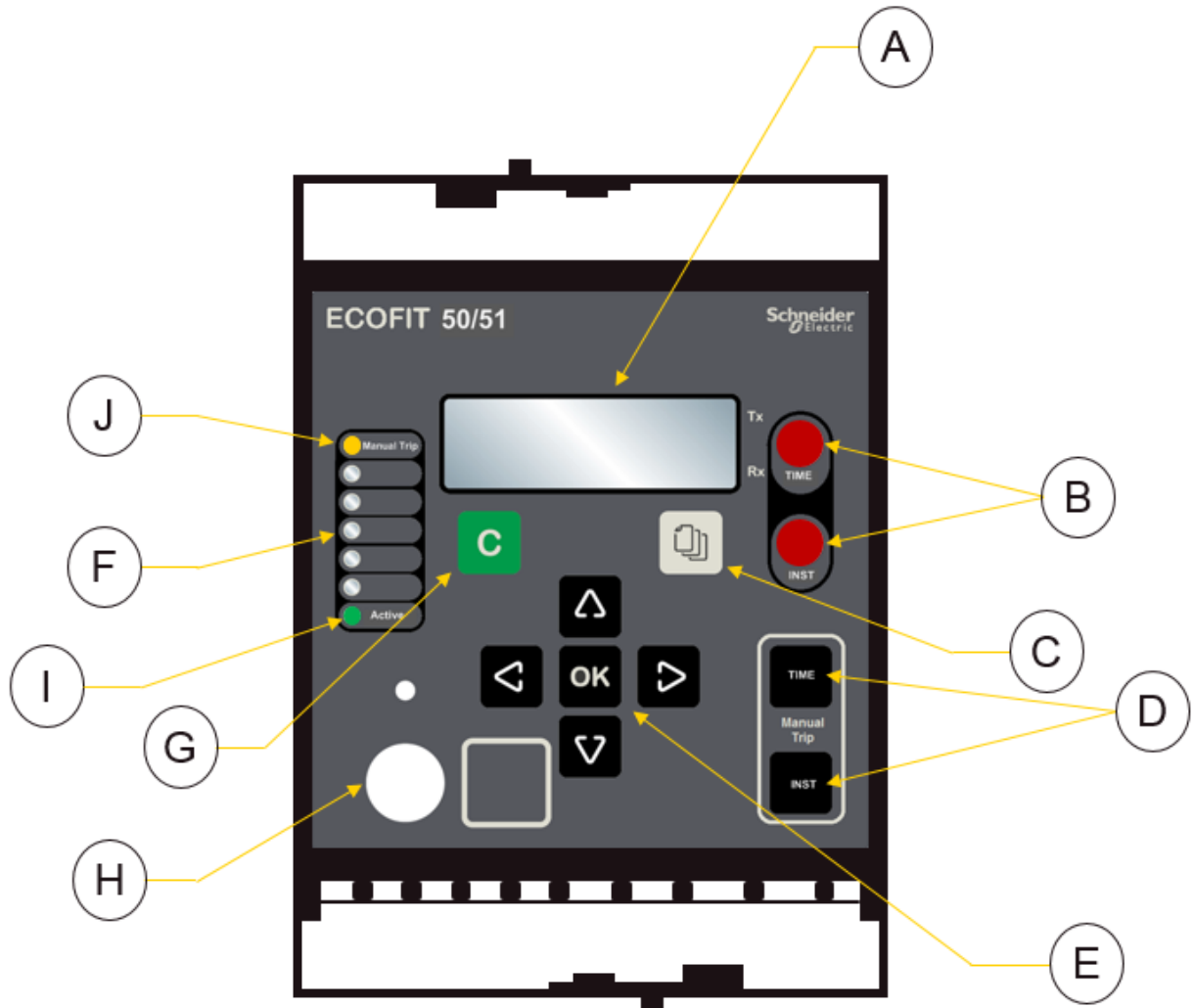


Figure 3-1: Front panel presentation

Table 3-1: Functions' descriptions

Function Reference	Control or indicator	Function Description
A	HMI Display	16 x 2 alphanumerical LCD display. It informs users about settings, measurements and overcurrent faults. It allows users to configure & set the relay parameters without need of a software tool.
B	Trip Indicators	Two red magnetic trip indicators (TIME and INST) help to indicate relay's operation. They stay latched until user's acknowledgement.
C	Read button	It allows users to get information on detected faults and detected alarms.
D	Manual Trips	Two manual trips pushbuttons allow users to test output relays, when activated. These manual trip functions are password protected.
E	Navigation buttons	An intuitive pull down menu structure allows easy and quick navigation. Disabled functions are hidden to facilitate the navigation.
F	Programmable LEDs	5 programmable LEDs can be configured to start or trip of protection elements, detected alarms,
G	Clear button	It clears detected alarms and resets indicators once they are acknowledged.
H	USB port	USB port allows data extraction and easy configuration of the relays using Easergy Studio software.
J	Active LED	Shows that the relay is powered up and is healthy.
K	Manual Trip Mode LED	Shows that the relay is in Manual Trip mode and the Manual Trip buttons are active.

3.2 RELAY POWER UP

As a self-powered relay, ECOFIT 50/51 does not have auxiliary power inputs. It can be powered up from either measured current from CT or the USB port.

3.2.1 Powering up from measured current

Under load condition, the relay will be powered up from current in its CT input. The functionalities per current level is detailed in Table 3-2.

Table 3-2: Relay functionality at different current levels

Current Level	Available Services
Between $0.2 \times I_n$ and $0.4 \times I_n$	Limited functionality: - Output RL1 - Magnetic flags - LEDs - Records (overcurrent fault, events and disturbance) Note: RL2, and HMI Display are disabled
Over $0.4 \times I_n$	Complete functionality: - Output RL1 & RL2 - Magnetic flags - LEDs and LCD - Records (overcurrent fault, events and disturbance)

3.2.2 Powering up from the USB port

The relay can be powered up through its USB port from a PC (or a power bank).

Connector: type mini B 5-pin male USB 2.0

USB Cable: USB 2.0, minimum 28AWG/1P + 24AWG/2C, maximum 2m

The USB connection allows the following functions:

- Relay powering for testing
- Settings configuration using Easergy Studio software
- Data (e.g. events and disturbance records) extraction using Easergy Studio software
- Relay firmware updating
- Programming through front panel keys
- Overcurrent fault acknowledgement and resetting indicators











Note: This port is not meant to be used as a permanent power supply to the relay.

3.3 USER INTERFACES AND MENU STRUCTURE

The settings and functions of the ECOFIT 50/51 protection relay can be accessed both from the front HMI (keypad and LCD), and via the front communication ports. This section focuses on relay interaction via its HMI. Communication through relay front port is explained in next section.

3.3.1 Special symbols on the LCD display

The following special symbols may appear on the relay display:

-  - It is possible to move up by pressing the up key.
-  - It is possible to move left by pressing the left key.
-  - It is possible to move down by pressing the down key.
-  - It is possible to move right by pressing the right key.
-  - The last menu cell in the column. If the down key is pressed, the cursor will reach the first cell in the column.
-  - It is possible to edit the displayed setting.
- <0.2 38> - Setting range: from 0.2 to 38 for 1A version or 1 to 190 for 5A version
-  0.01 - Setting value step: 0.01.
-  - Password-protected: No edition of the settings
-  - Edition of settings are possible (the correct password has been entered)
-  - A detected alarm is still active (the cause of detected alarm is highlighted)

3.3.2 ECOFIT 50/51 Menu description

The Main Menu is shown in Figure 3-2.

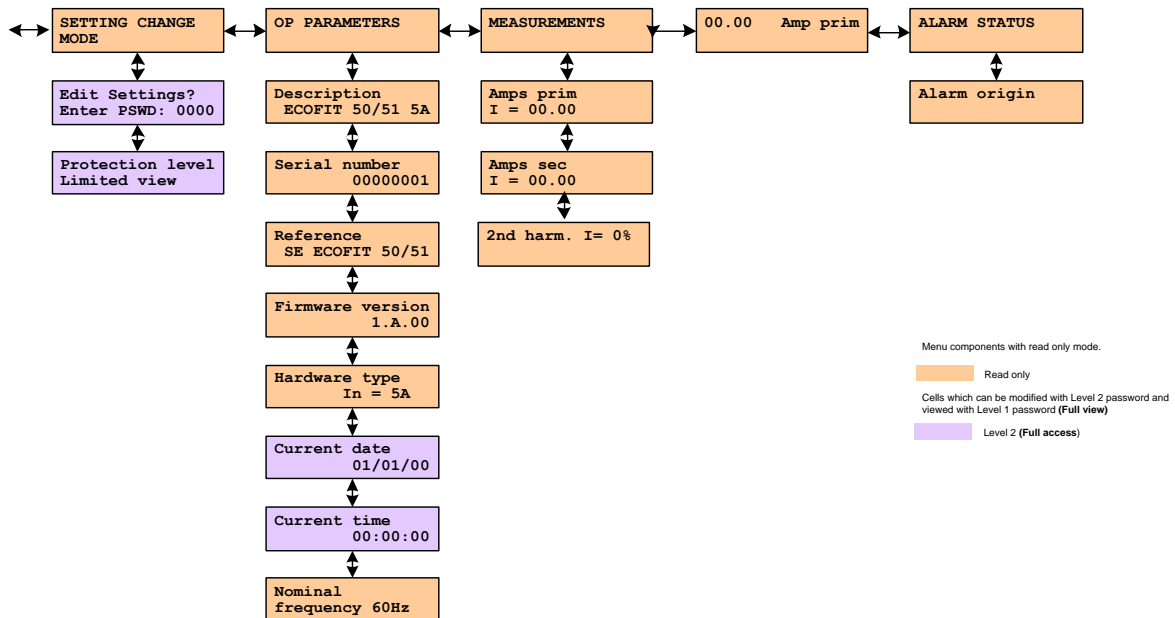


Figure 3-2: Main Menu

3.3.2.1 GLOBAL SETTINGS

Global Settings include general settings, such as:

- Local settings (**LOCAL SETTINGS**)
- Current transformer parameters (**CT RATIO**)
- Circuit Breaker Diagnostic (**CB DIAGNOSTIC**)
- Advanced settings for the over-current protection (**50/51 ADVANCED**)
- Inrush Blocking Logic (**INRUSH BLOCKING**)
- Disturbance recorder parameters (**DISTURBANCE RECORDER**)

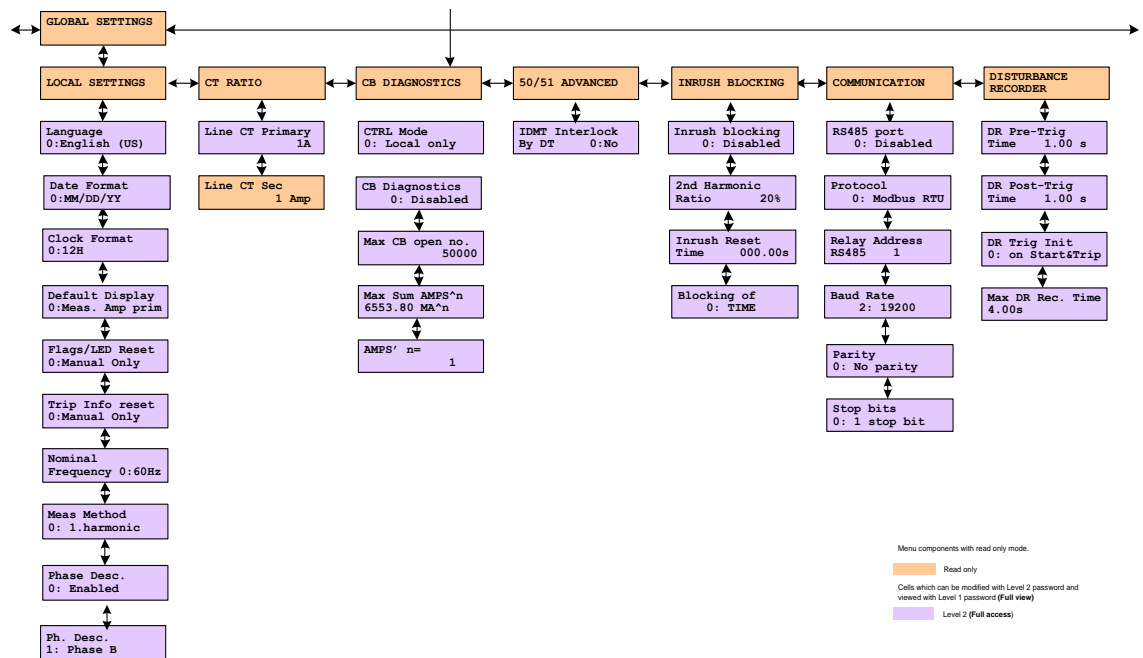


Figure 3-3: GLOBAL SETTINGS menu

3.3.2.2 50/51 PROTECTION

50/51 Protection menu includes settings for protection elements (TIME, TIMEBAK and INST).

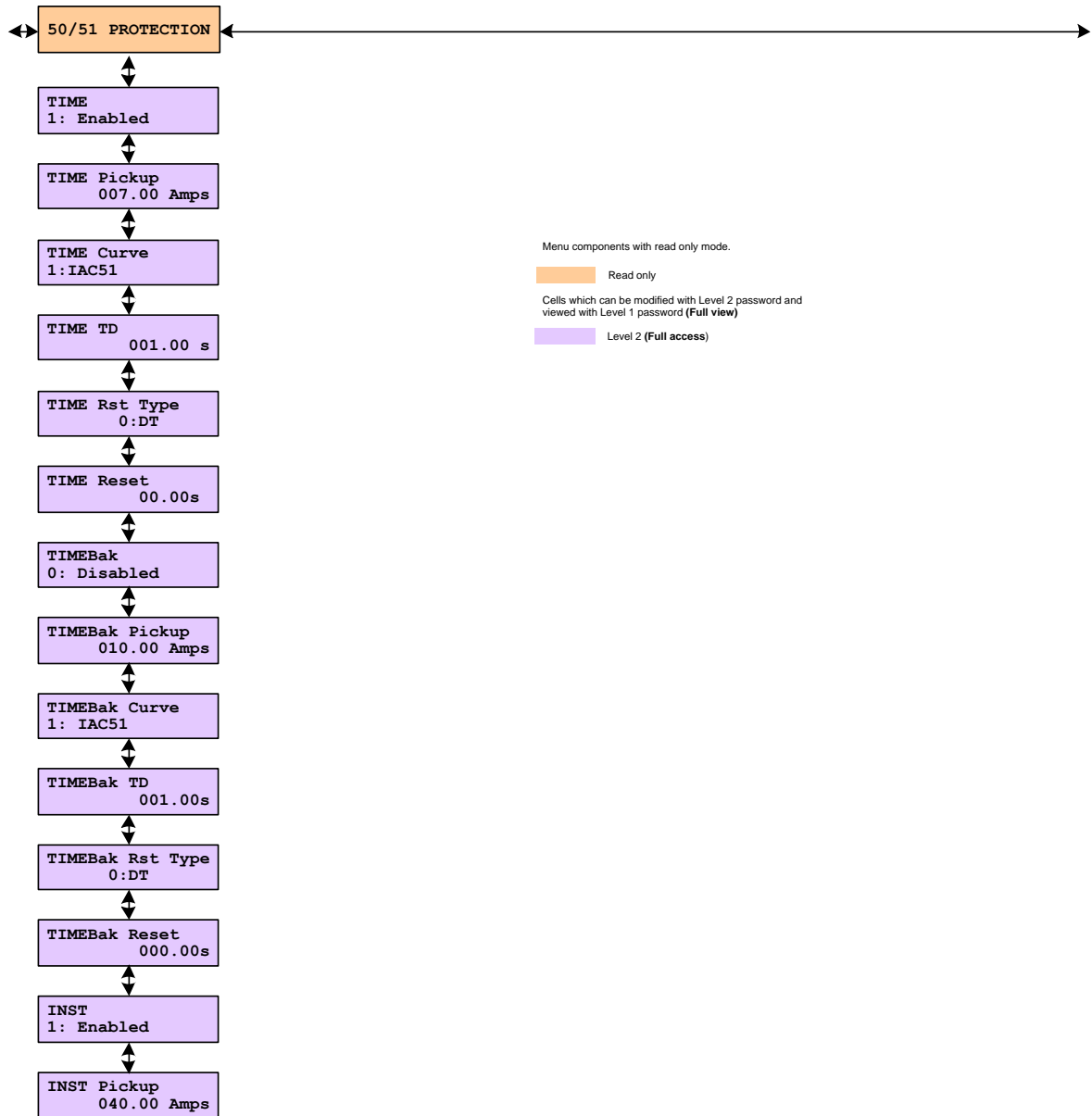


Figure 3-4: PROTECTION menu

3.3.2.3 OUTPUT RELAY CONFIGURATION

Output assignments for each protection element could be done through front panel.

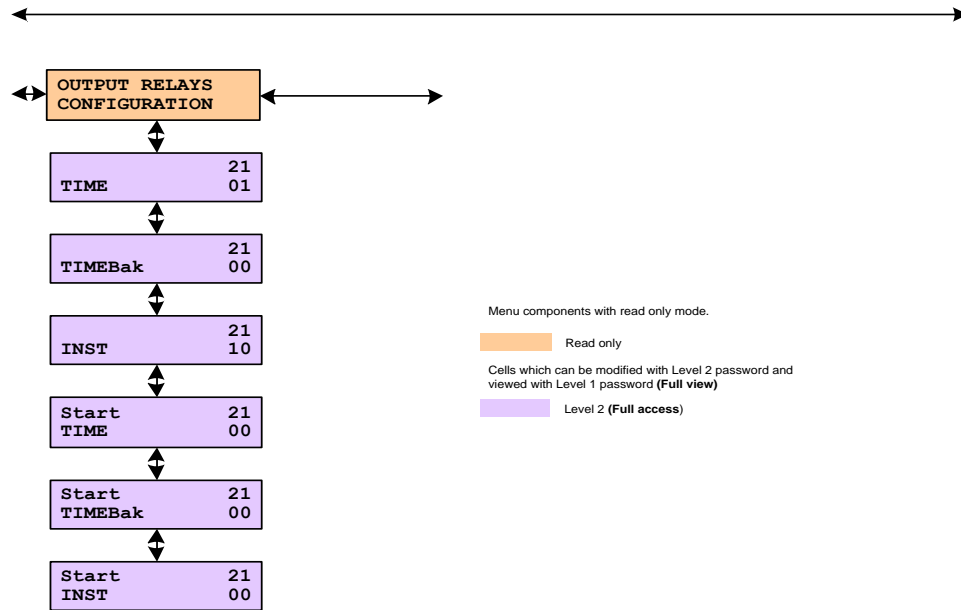


Figure 3-5: OUTPUT menu

3.3.2.4 LEDs CONFIGURATION

LED assignments for each protection element could be done through front panel.

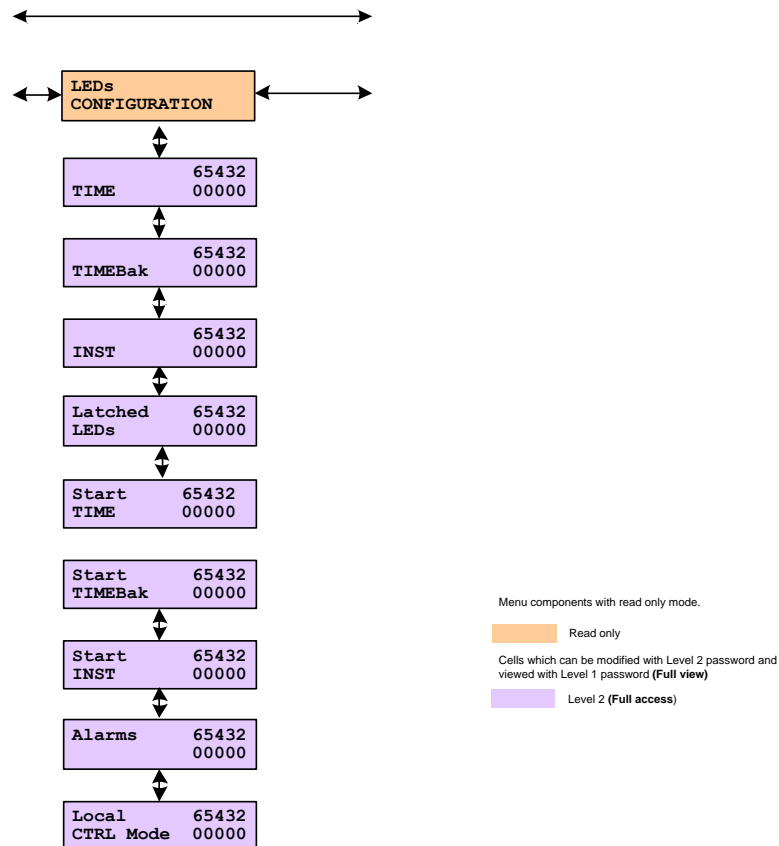


Figure 3-6: LED menu

3.3.2.5 RECORDS

Twenty overcurrent fault records are available in the relay.

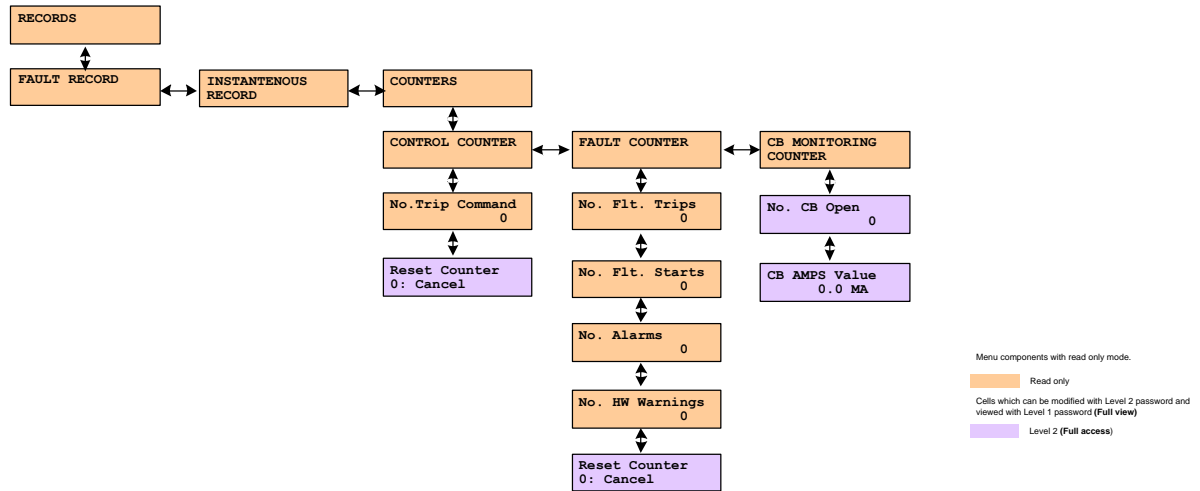


Figure 3-7: RECORDS menu

3.3.2.6 MANUAL TRIP MODE

Manual Trip can be Enabled through relay’s HMI, which allows user to test manual trip function.

Note: Two buttons (TIME and INST) located on right bottom corner of the relay are dedicated for Manual Trip functions. TIME button is dedicated to test TIME/TIMEBak element and their assigned outputs. INST button is dedicated to test INST element and its assigned outputs. These manual trip buttons are not operational during normal conditions. To activate them, Manual Trip Mode needs to be enabled and an USB cable needs to be connected to the relay through its USB port. If Manual Trip Mode is enabled, the LED1 (orange) will activate for indication purpose. Manual Trip Mode will automatically turn off after 10 mins of inactivity.

Once a manual trip button is pressed, the output relay closes and stays in this position until the button is released.

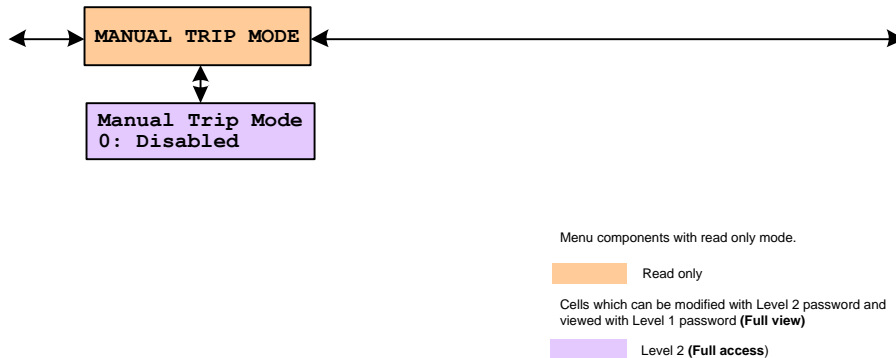


Figure 3-8: MANUAL TRIP MODE menu

3.4 LOCAL COMMUNICATION TO A PC AND USE OF EASERGY STUDIO

Easergy Studio is the universal software that supports ECOFIT 50/51 relay. It allows users to upload settings to the relay as well as download/extract settings, events and disturbance records from the relay using an USB communication via relay's front port.

3.4.1 Configuration

The relay parameters could be accessed and modified using Easergy Studio software installed on a PC. Communication can be established by using a USB cable between PC and the relay's front port. The Easergy Studio 7.1.0 (or higher) software has a built-in USB driver and virtual COM software. No additional driver is required after installation of the software.

NOTICE
<p>PRODUCT DAMAGE DUE TO STATIC ELECTRICITY DISCHARGE</p> <ul style="list-style-type: none"> • Before connecting the USB cable to the relay, it is necessary to discharge static electricity from the body by touching a grounded bare metal object. <p>Failure to follow these instructions can result in equipment damage.</p>

3.4.2 Easergy Studio 7.x.x

Easergy Studio is the official software package to interact to an ECOFIT 50/51 relay. This software package let the user set the relay settings, extract the relay settings and make backups, extract relay recordings and counters, analyze the recordings, and much more.

The Easergy Studio can be downloaded from www.schneider-electric.com. In the search field enter "Easergy Studio" and press Enter.

The screenshot shows the Schneider Electric website search interface. The search bar contains 'easergy studio' and the results page displays two main entries:

- Easergy Studio**: 05 May 2017 ... The current **Easergy Studio** brings enhanced usability while preserving the rich features of its previous versions. **Easergy Studio** Software Request A link to download the **Easergy studio** software can be found...
 - Product Offer
- Easergy Studio V7.1.0**: 27 January 2017 ... 122 **Easergy Studio** #12.rev A <http://www.schneider-electric.com> 1. New features 1.1. P40 Disturbance trigger from **Easergy Studio** Description ? Triggering a disturbance record via **Easergy Studio**...
 - ZIP | 813.2 MB | DE/FR/PL/ES/EN | Software - Released | Easergy Studio V7.1.0 | Document number Easergy Studio V7.0.0 Installer
 - PDF | 892.0 KB | DE/FR/PL/ES/EN | Software - Released | Easergy Studio v7.1.0 - Release Notes v1.0 | Document number Easergy Studio V7.0.0 Installer

The left sidebar shows navigation options for 'Documents and software', 'Product information', and date filters.

Figure 3-9 : Easergy Studio search results

Click on “Easergy Studio V7.x.x:

The screenshot shows the Schneider Electric website's download page for Easergy Studio V7.1.0. The page features a green header with the Schneider Electric logo and navigation links: PRODUCTS, SOLUTIONS, SERVICES, SUPPORT, and ABOUT US. Below the header is a breadcrumb trail: Home > Support > Download Center > Easergy Studio V7.1.0. The main content area displays the product name 'Easergy Studio V7.1.0' in green. To the left is a thumbnail image of the software installer. To the right, there are two blue buttons: 'Download All (.zip)' and 'Add to my Documents'. Below these buttons is a 'Copy URL' field containing the address 'http://www.schneider-electric.com/en'. Further down, there are sections for 'Reference' (Easergy Studio V7.0.0 Installer), 'Type' (Software - Released), 'Languages' (German/Spanish/English/French/Polish), 'Date' (26/01/2017), and 'Version' (2.1). At the bottom left, there is a 'Product Ranges:' section with a link to 'Easergy Studio'.

Figure 3-10: Easergy Studio download page


Click on Download All (.zip): This will download the Easergy Studio software package as well as the release notes. Please read the release notes before proceeding with the installation of Easergy Studio.

3.4.2.1 Data Model Management

The settings and parameters of the protection relay can be extracted from the relay or loaded using the Data Model manager. The Data Model Manager can load any model from a local file, an external disks/drives or an Internet server (if connected).

The Data Model Manager is used to add and remove data models, as well as to export and import data model files.

It is necessary to close Easergy Studio prior to launching the Data Model Manager.

To open the Data Model Manager, click on the Windows Start icon: . Go to All programs > Schneider Electric > Easergy Studio > Data Model Manager.

The following window is displayed:

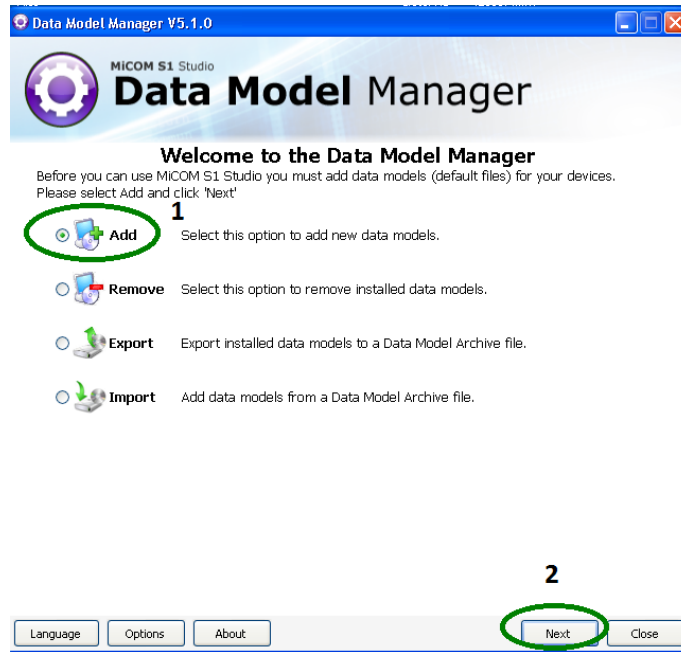


Figure 3-11: Data model manager – Welcome page

Select the **Add** option to add the new data model, then click on **Next**.

The next window let the user select the data model's source: CD ROM, local folder, or Schneider Electric server. Select **Internet** then click on **Next**.

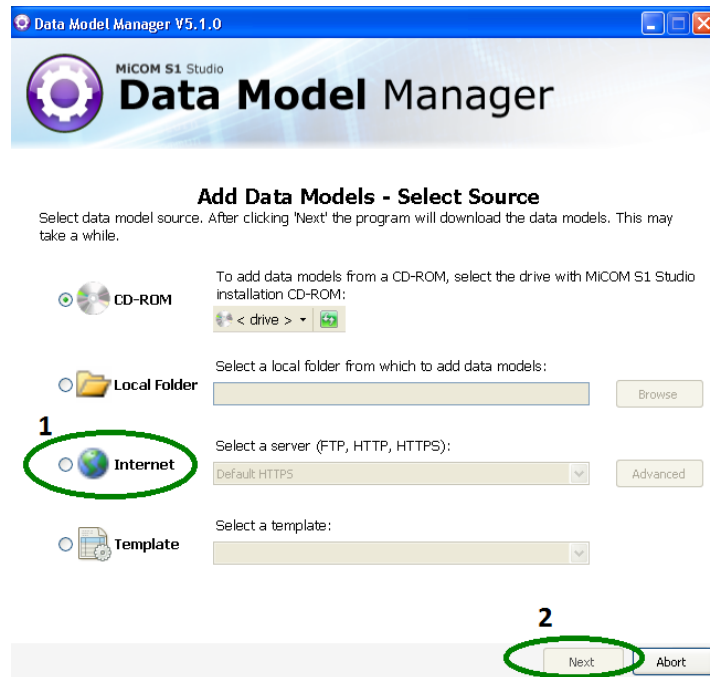


Figure 3-12: Data model manager – Source Selection

Note: The procedure below assumes connection to Schneider Electric server is established.

The Data Model Manager loads the data models' details then automatically displays the language selection panel. Select **English**, then click on **Next**.

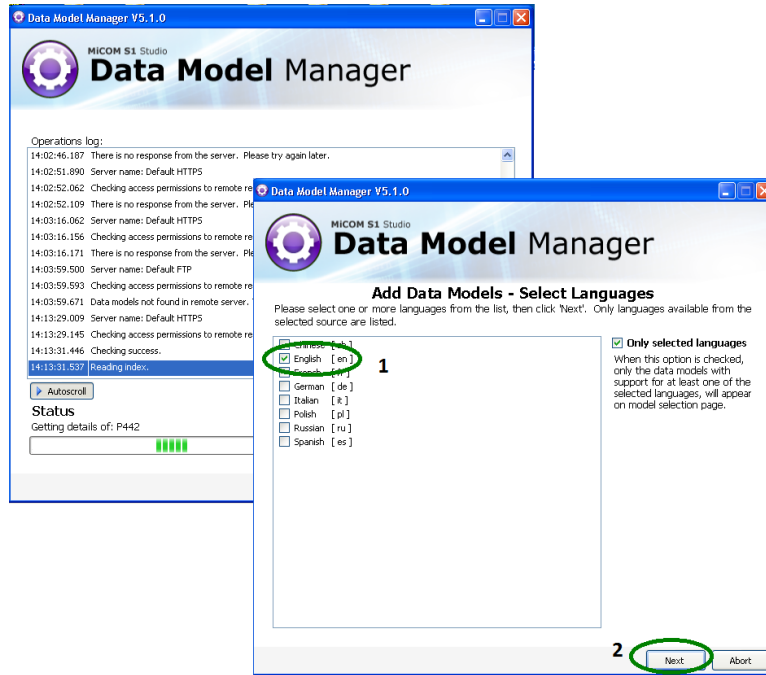


Figure 3-13: Data model manager – Language

The data models panel is displayed. Select the data model relevant to your product: Expand the **Px10/V11x/Px20/Px20C/M/Modulex** sub-menu by clicking on the + sign, then select the **ECOFIT**. The Data Model Manager displays the Selected files size at the bottom of the window.

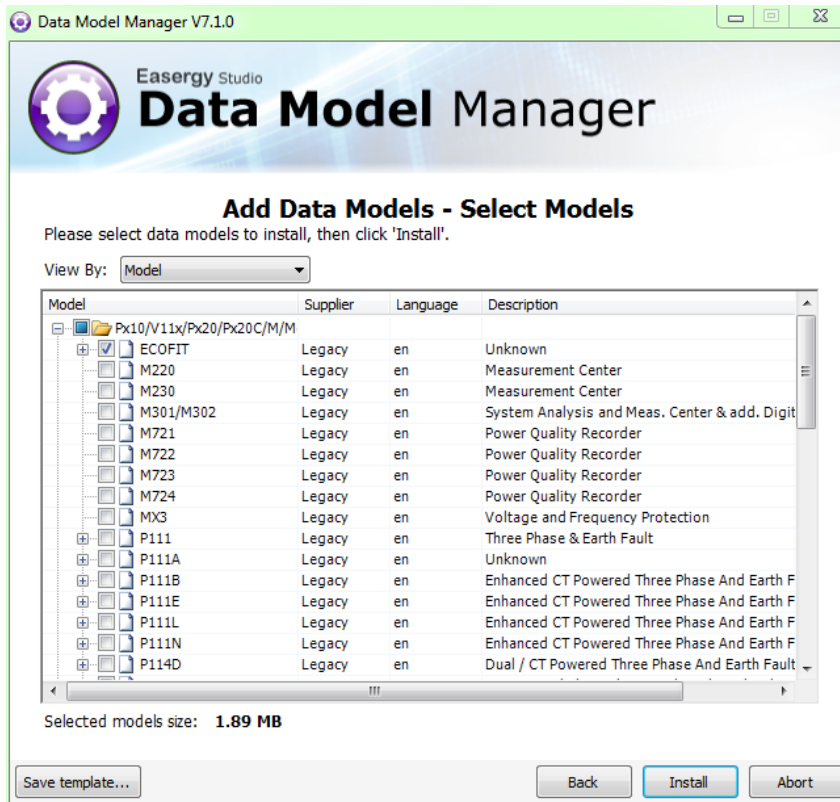


Figure 3-14: Data model manager – Relay models selection

Click on **Install**. The data model files are downloaded and updated in your system.

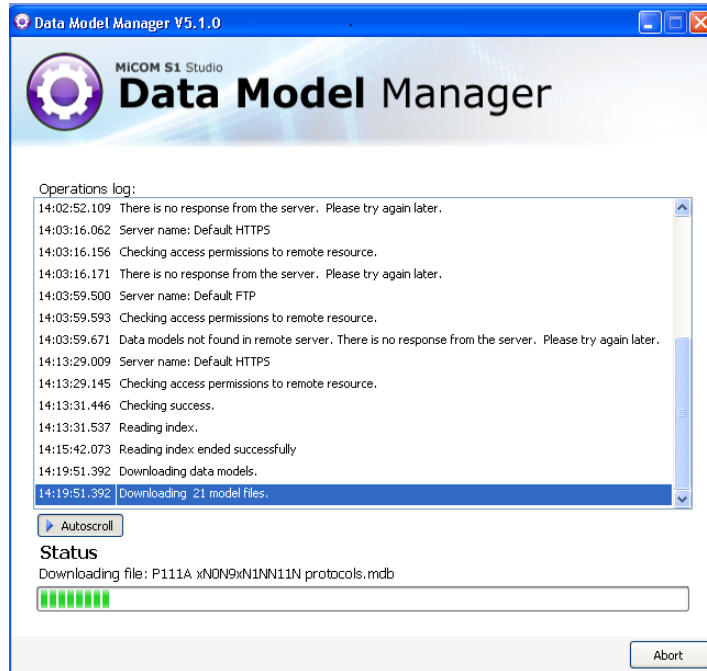



Figure 3-15 : Data model manager – Operations Log

Once installation is complete, close the Data Model Manager. The downloaded Data Model will be used by Easergy Studio when a system file is opened or created. For more information on how to open this default setting file, refer to sub-chapter 0.

3.4.2.2 Quick Connection to the relay

To start Easergy Studio, click on the Windows Start icon: . Go to All programs > Schneider Electric > Easergy Studio > Easergy Studio.

The Easergy Studio launcher screen is displayed:

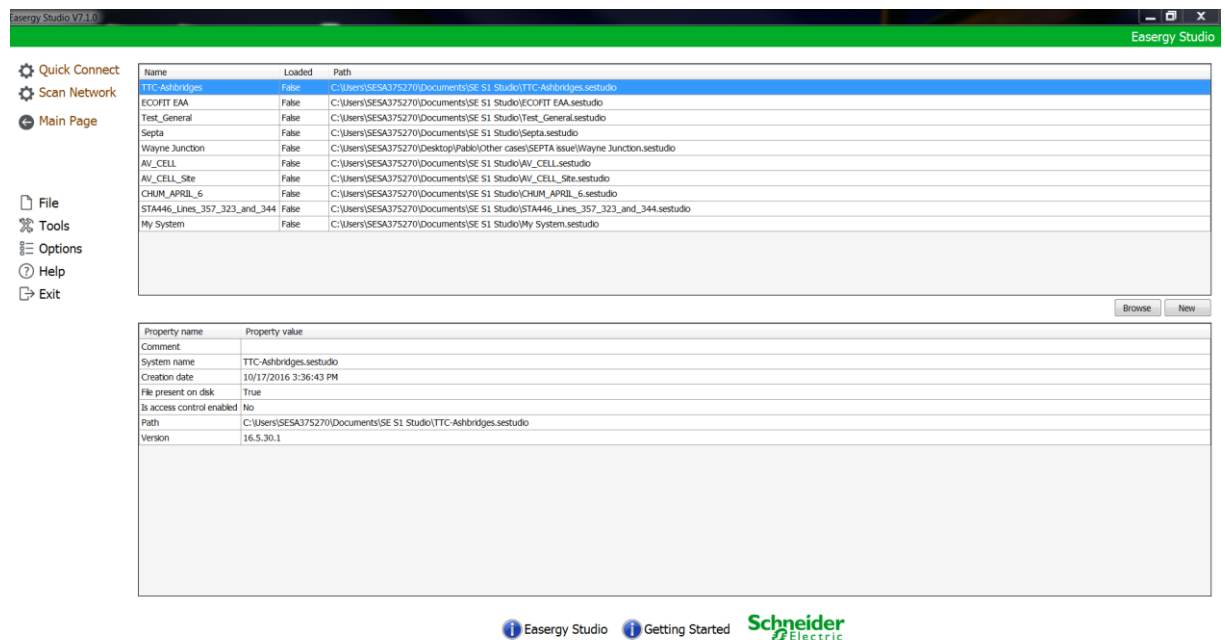


Figure 3-16: Easergy Studio – Welcome page

Click on the Quick Connect button at the top left of the application's window. You can choose to create a new system or open an already created system.

Select **Px10/V11x Series** from the presented options.

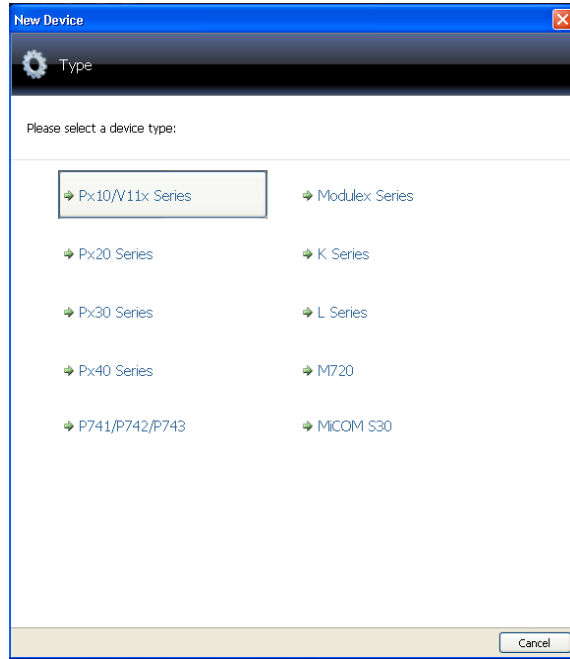


Figure 3-17: Easery Studio – New Device

Select Front USB port.

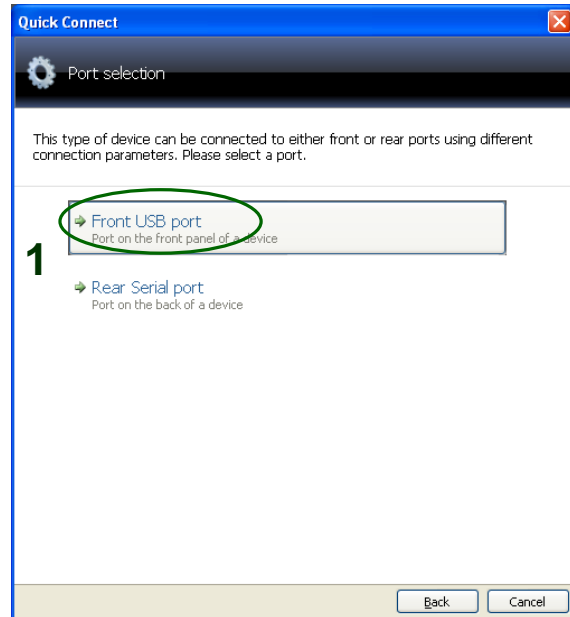


Figure 3-18: Easery Studio – Quick Connect

Enter Password: administrator level (without limits) - the same as in the relay which is connected via USB port. If the administrator password is not entered in the relay – leave it as default.

Select virtual COM (VCP) which was created by USB driver.

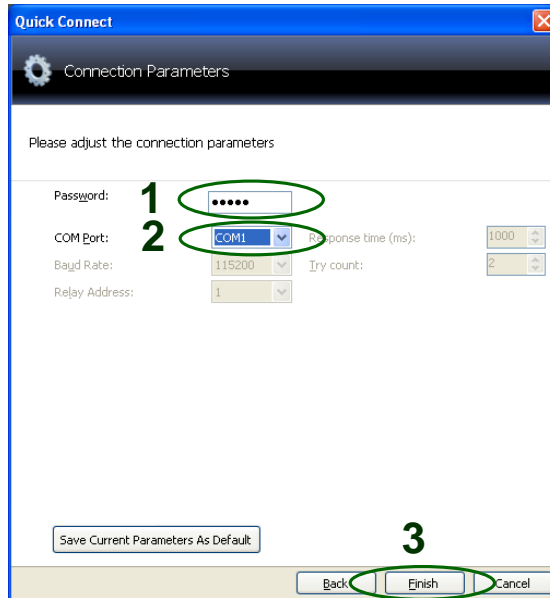


Figure 3-19: Easery Studio – COM port selection

The virtual COM can be read in WINDOWS's "Device Manager" shown below:

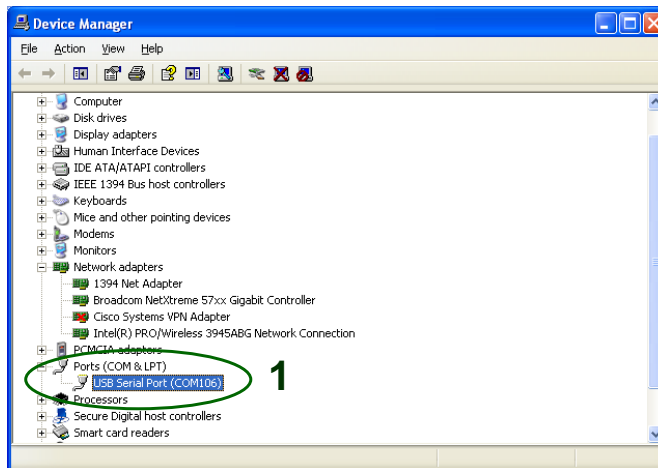


Figure 3-20: Device Manager - Ports

NOTE: If ECOFIT 50/51 is connected to the computer, but no USB Serial port is shown, follow instruction on section 3.4.3 Troubleshooting USB connection.

Enter a Relay Name and Comment.

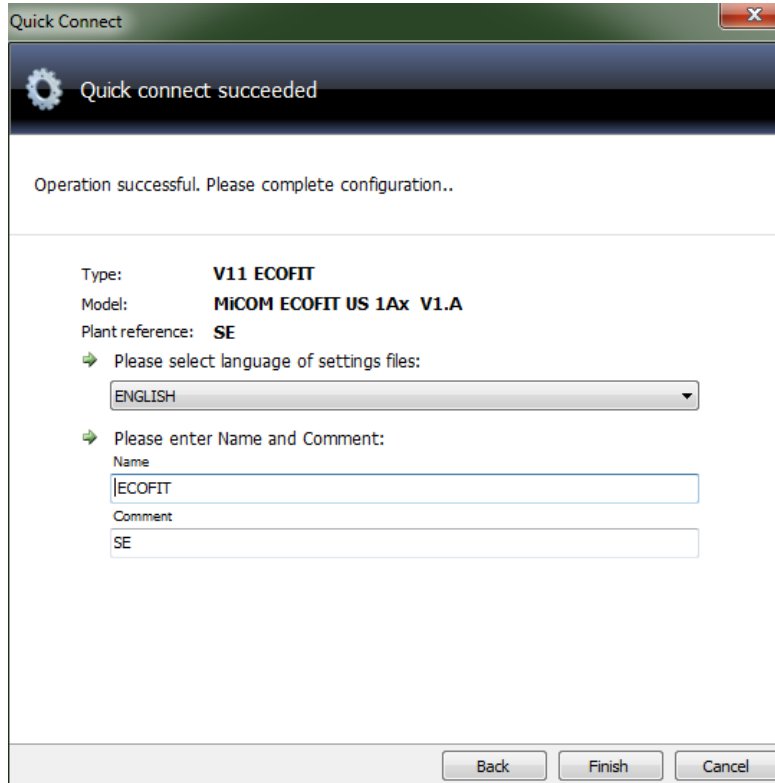


Figure 3-21: Relay identification

By pressing the Finish button, a new device is created in Easergy Studio as shown below. Select **Settings**. Right-click to open the contextual menu: **Extract Settings**. This maneuver will read settings of the relay.

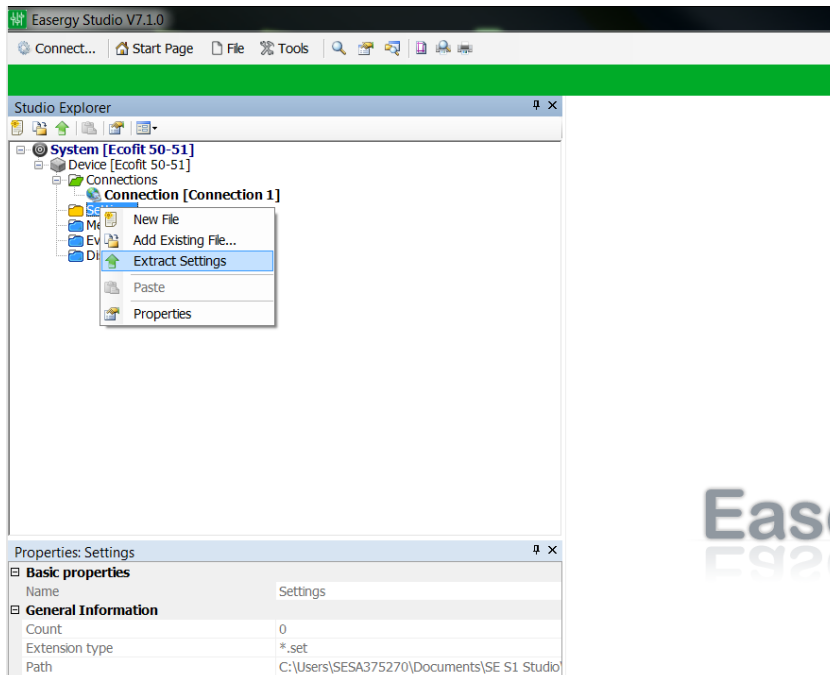


Figure 3-22: Setting extraction

Once the process is completed, the setting file of the relay will be saved to the computer. The SET file will be named 000.set. Double Click on **000.set** file to see settings on the right window of Easergy Studio

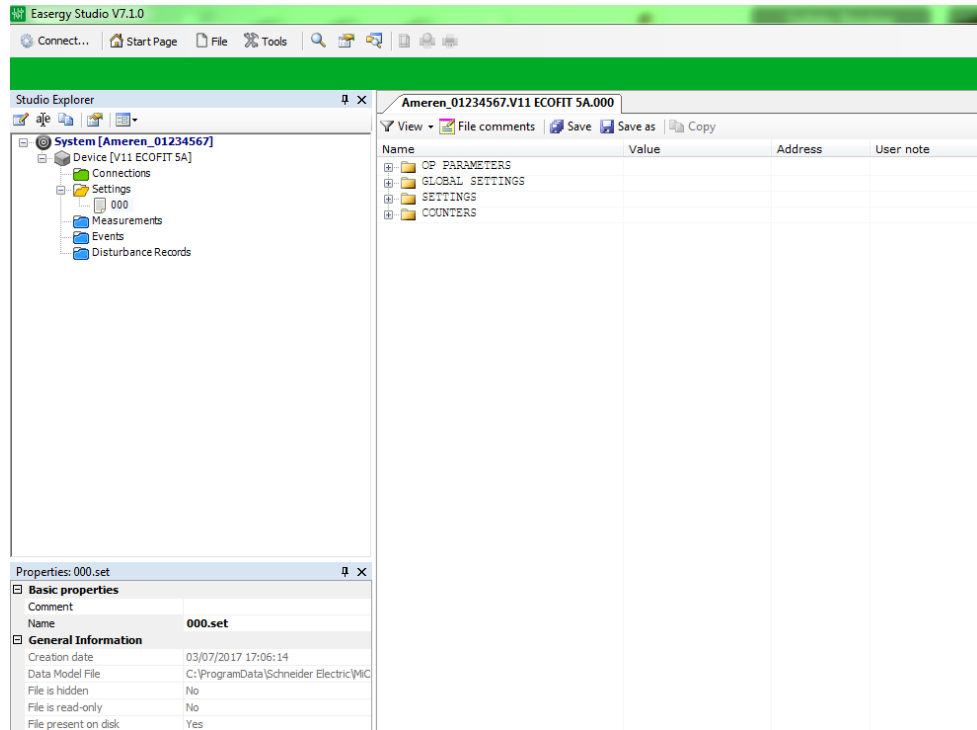


Figure 3-23: Relay settings in Easergy Studio

Settings need to be saved following modifications. If the changed settings are not **Saved** on hard disk of PC, they appear in red in Easergy Studio.

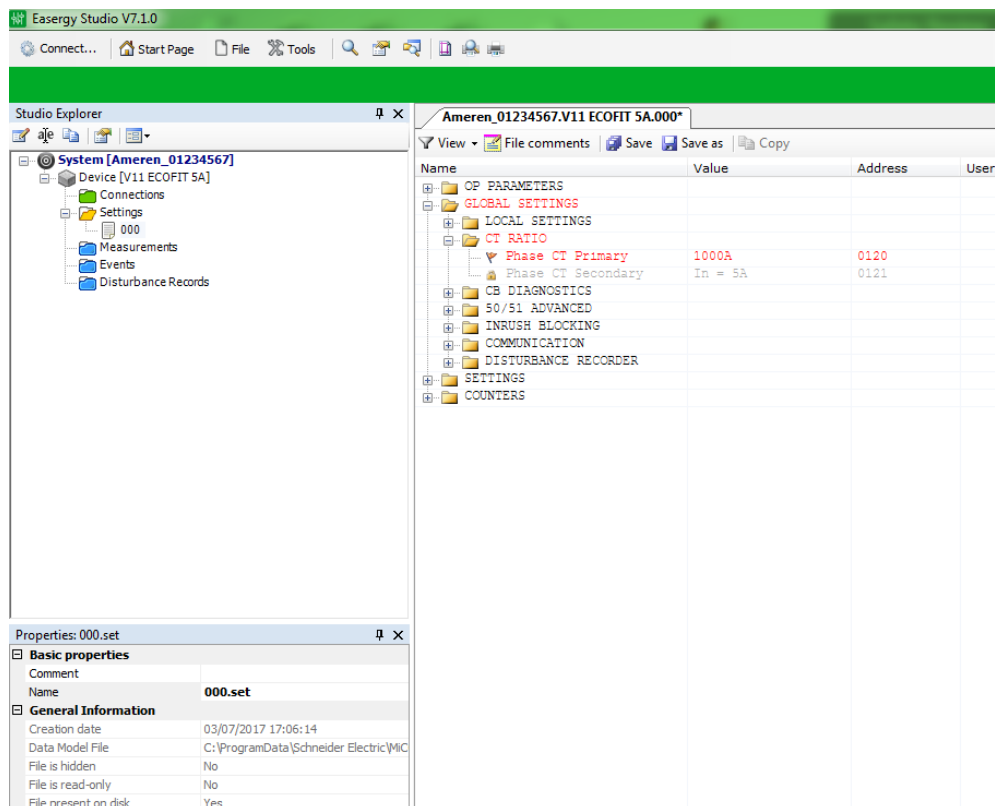


Figure 3-24 : Setting change in Easergy Studio

Click on the name of **Device** and right-click to open the contextual menu: **Send**.

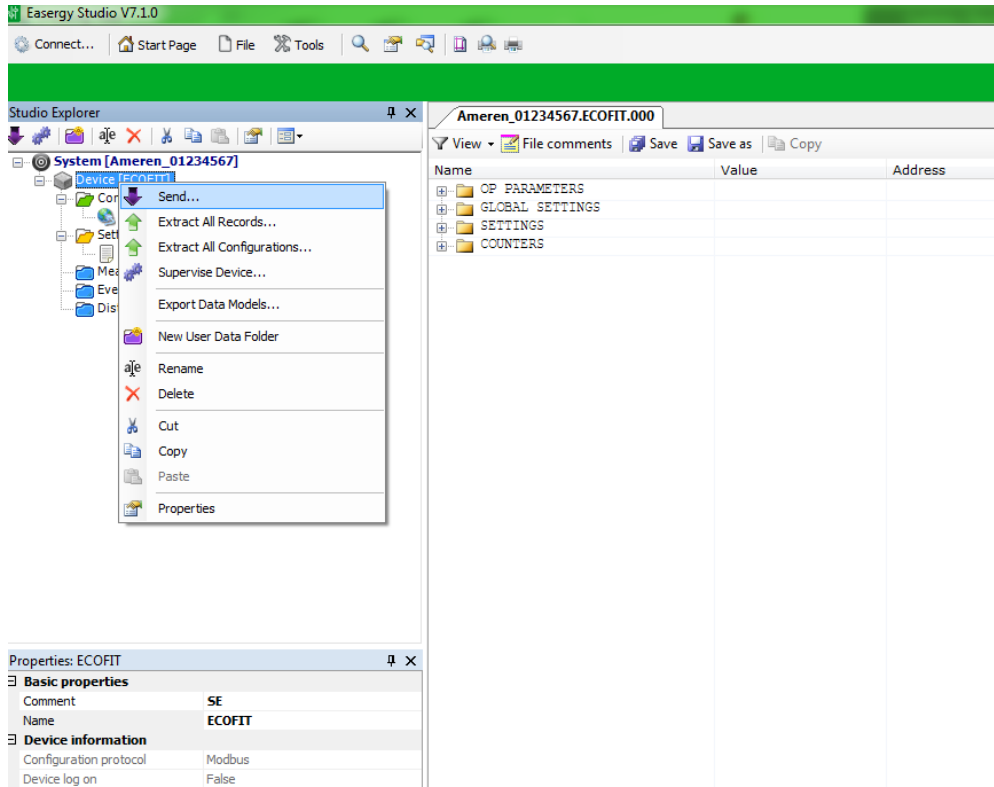


Figure 3-25: Sending setting file to the relay

Select setting (**000.set**) file for sending. Press **Send**.

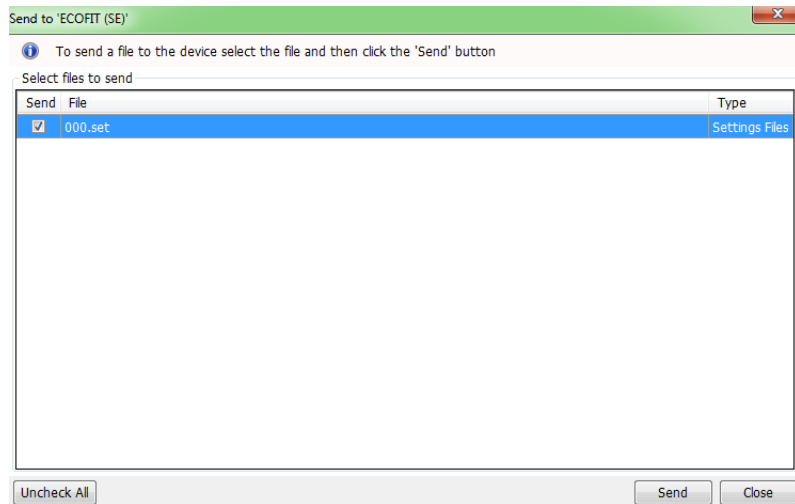


Figure 3-26: Selecting the setting file to be sent to the relay

If **000.set** file was saved on the PC disc, press **Yes**.

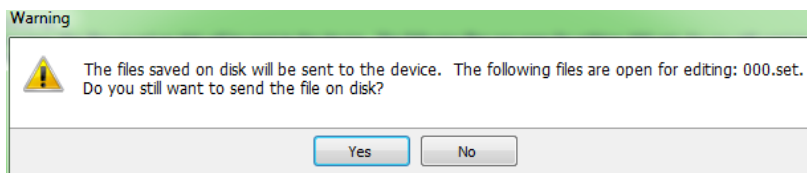


Figure 3-27: Confirmation window

Wait for the end of operation and press **Close**.



Figure 3-28: Events while sending

3.4.2.3 Create a system

In Easergy Studio, a System provides a root node in the Studio Explorer panel from which all subsequent nodes are created.

Add substations, bays, voltage levels and devices to the system.

If a system is no longer needed, delete it using the delete command.

Systems are not opened automatically, unless **Reopen Last System at start-up** is checked in the Preferences menu.

To create a new system:

- By default, the window displays the message "create new or open existing system": click on "New" to create a new system.
- If a system is loaded in the "**Studio Explorer**" window, right-click on the panel's background and select "New System" or the corresponding icon on Studio Explorer's toolbar.

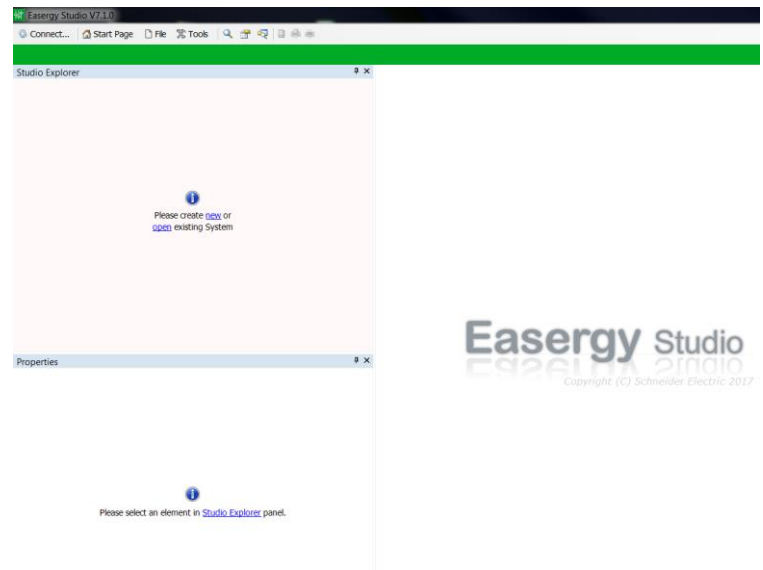


Figure 3-29: Easergy Studio – Main page

The following window is displayed: Enter the name of the system, and the path to save the system file. Click **OK**.

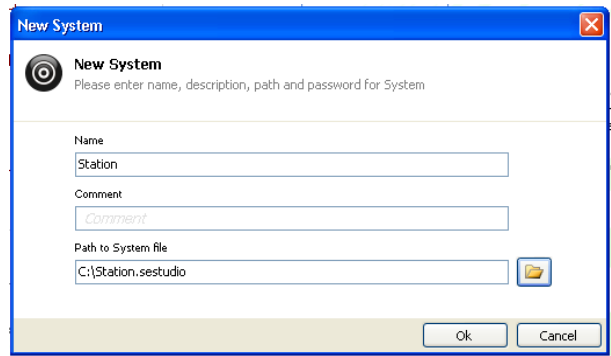


Figure 3-30: Creating a new system

The new System is displayed in the Studio Explorer panel:

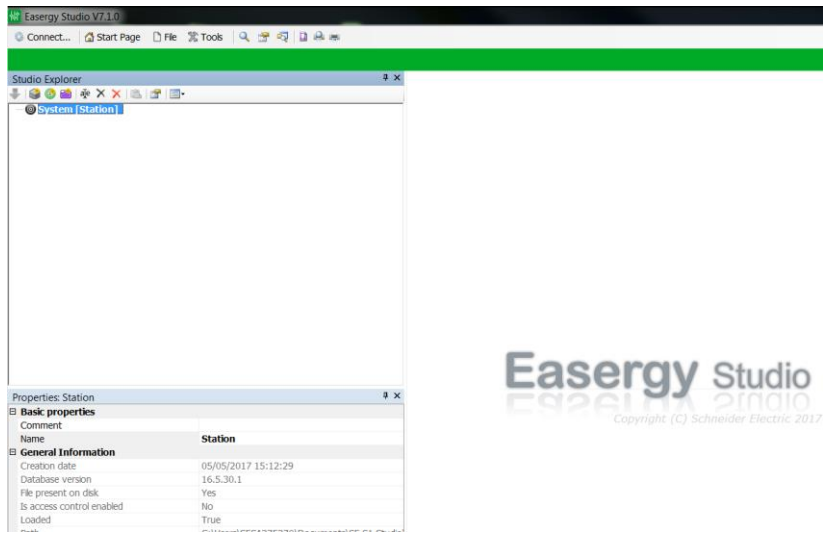


Figure 3-31: New system in Studio Explorer window

Note: If an item is selected in the Studio Explorer panel, its properties are displayed in the **Properties** panel.

3.4.2.4 Create a new substation

Select the system: the menu bar is updated with the **New device**, **New substation**, **Close**, **Delete**, **Paste**, **Properties** and **Options** icons.

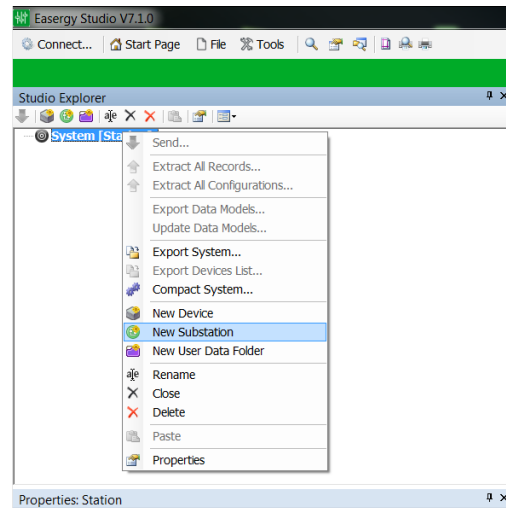


Figure 3-32: Creating new substaion

Click on the **New substation** icon (or right-click to open the contextual menu). In the popup window put the desired substation name and comment.

The new substation is displayed and the menu bar is updated when a substation is selected:

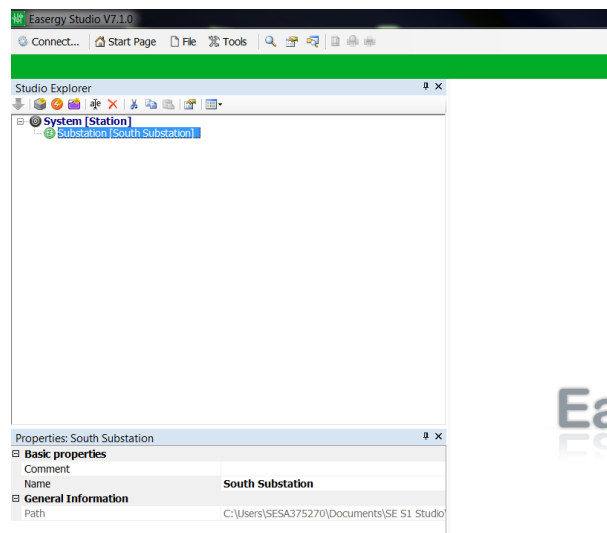


Figure 3-33: New substaion in Studio Explorer window

You could click on the **Import SCL** button to import a Substation Configuration File.

To create a substation configuration, click on the **New voltage level** button.

3.4.2.5 Create a new voltage level

Select the substation and click on the **New station level** button (or right-click to open the contextual menu).

In the **Create a new voltage level**, enter the voltage level of the station.

The **New voltage level** is displayed and the **New bay** icon is displayed.

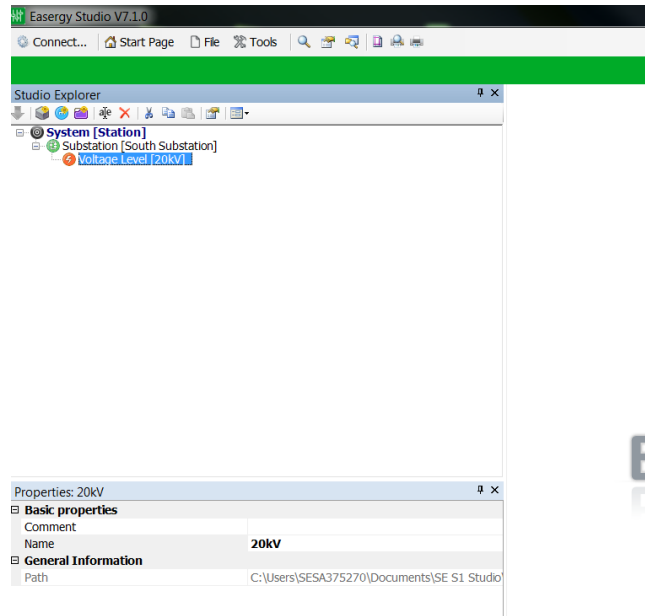


Figure 3-34: New voltage level in Studio Explorer window

3.4.2.6 Create a new bay

Select the substation and click on the **New bay** button (or right-click to open the contextual menu).

In the **Create new bay...** window, enter the bay indication,

The new bay is displayed.

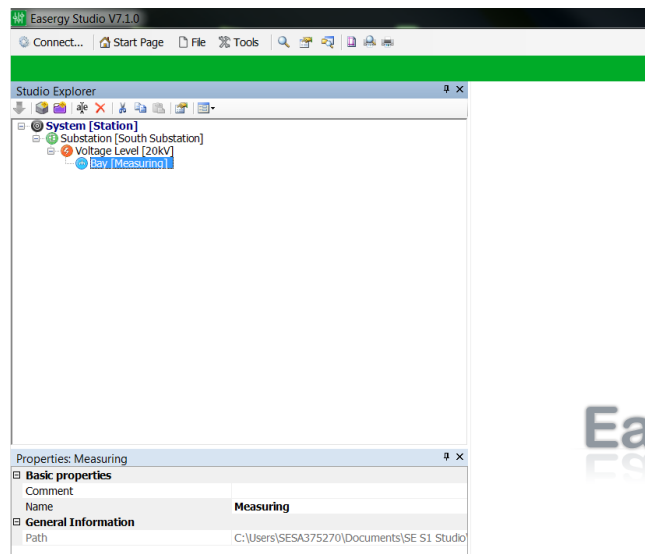


Figure 3-35: New bay in Studio Explorer window

3.4.2.7 Create a new device

Click on the **New device** button (or right-click to open the contextual menu).

Select the device type Px10/V11x Series, then click on **Next**.

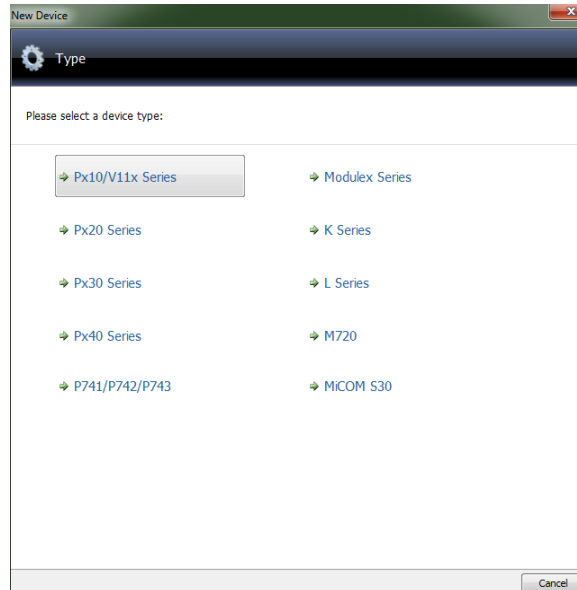


Figure 3-36: New device type selection

Select the model then click on **Next**.

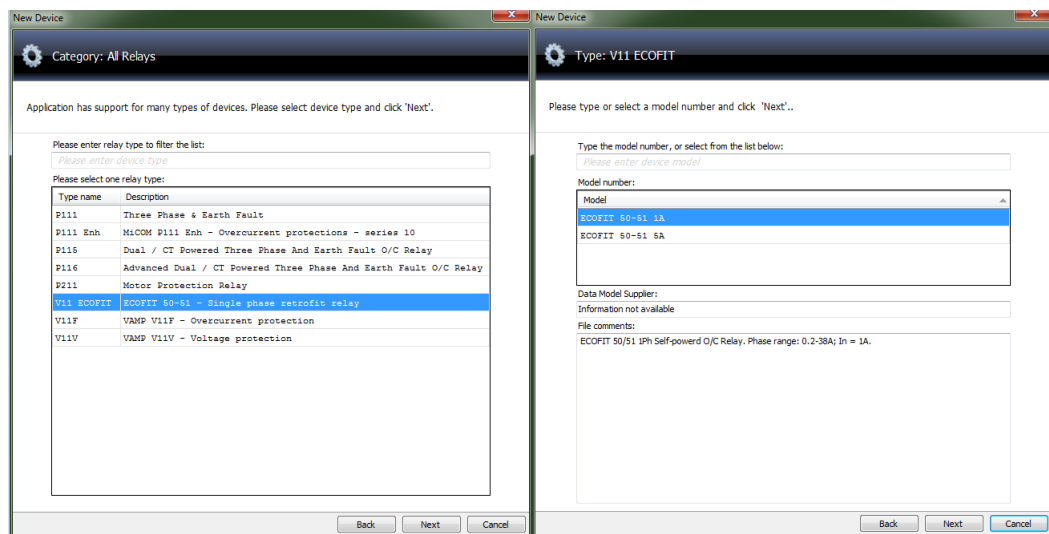


Figure 3-37: Selecting ECOFIT relay

Enter the relay ID and comment in the popup menu, and press the **Finish** button.

The new device is created and displayed.

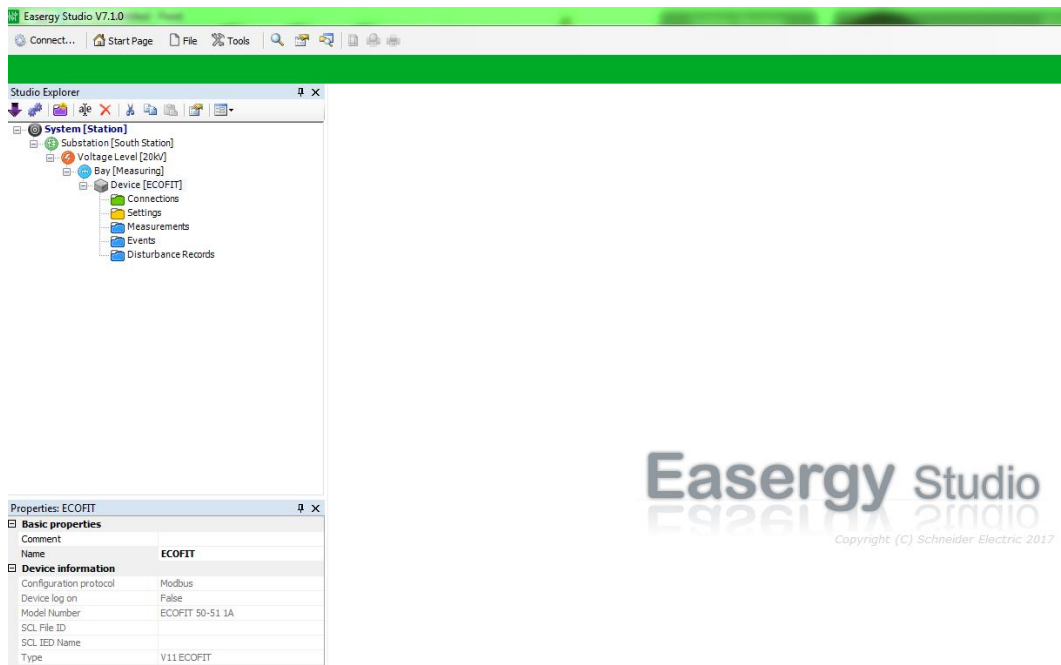


Figure 3-38: New device in Studio Explorer window

3.4.2.8 Open a Settings File

To open an existing file:

- If the file is saved or if the relay is not connected: Right-click on the **Settings** to open the contextual menu: **Add Existing file**

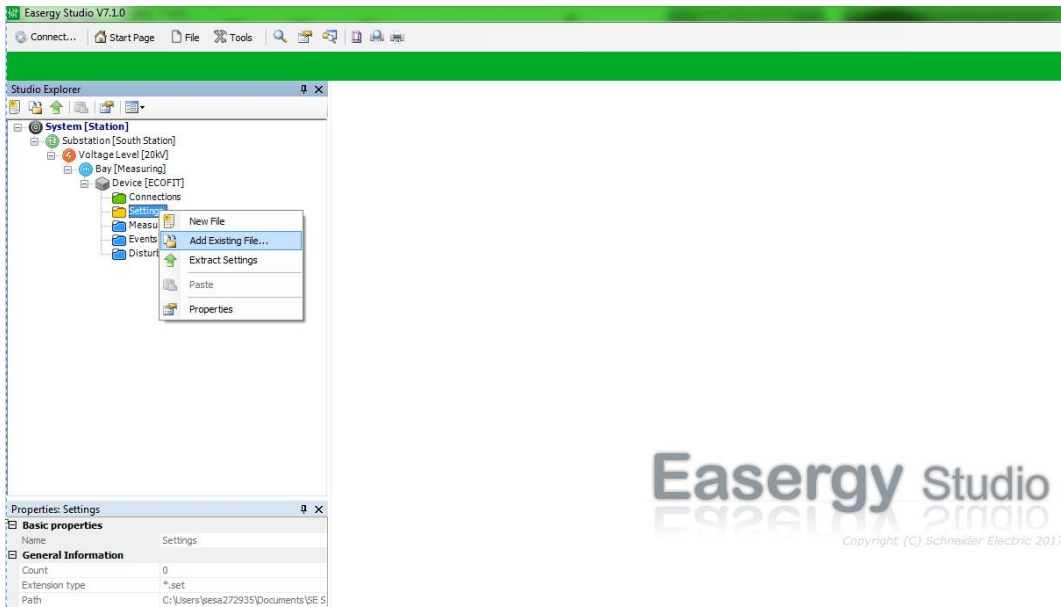


Figure 3-39: Add existing setting file

- If the relay is connected, extract its settings: Click on the **Settings** and right-click to open the contextual menu: **Extract Settings**

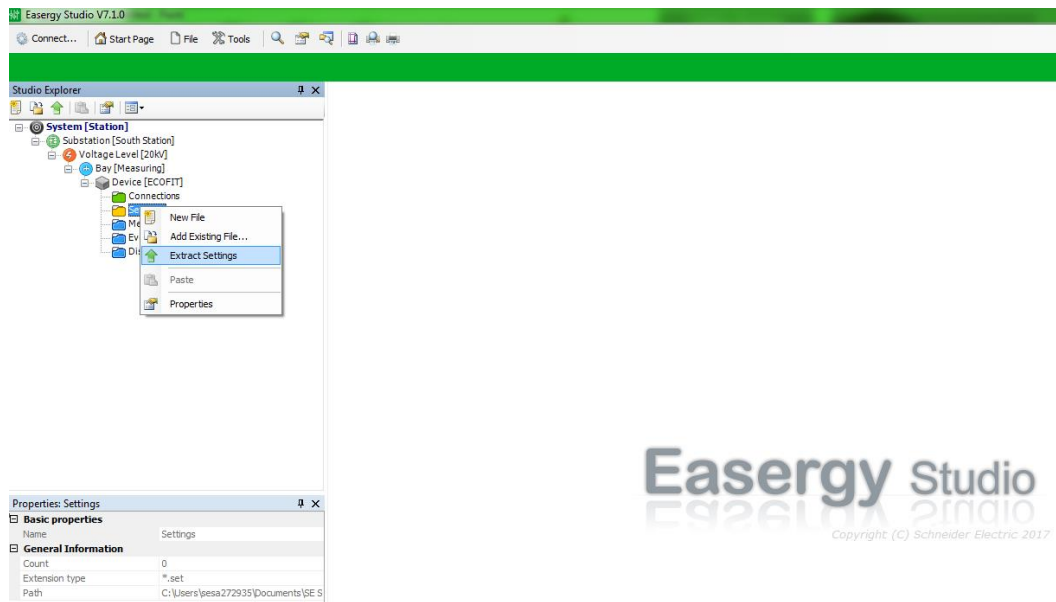


Figure 3-40: Extract settings from the relay

To open default settings:

- Click on the **Settings** and right-click to open the contextual menu: **New File**

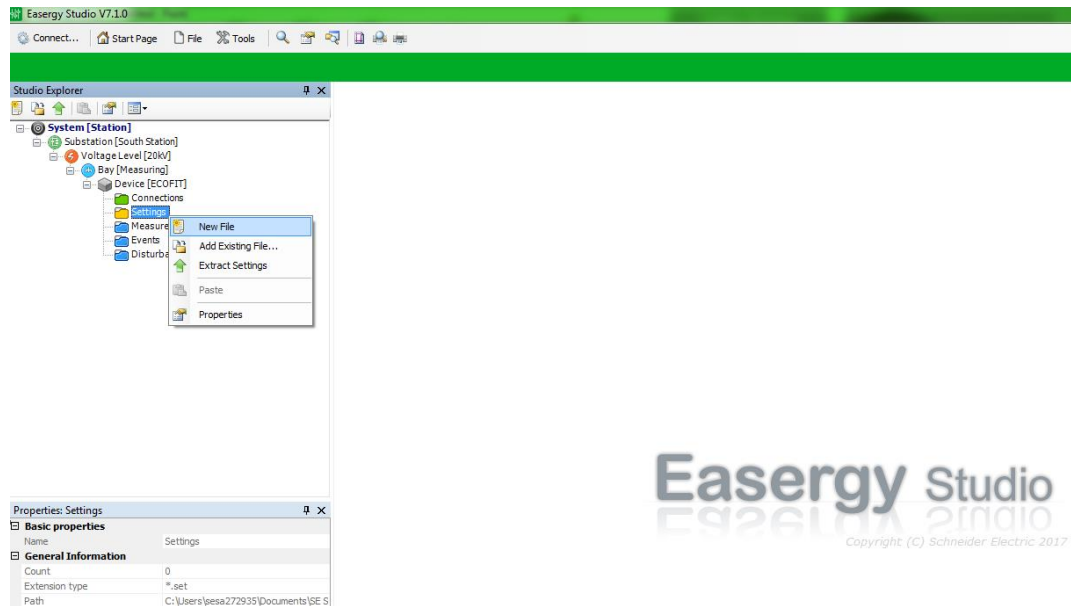


Figure 3-41: Add a default setting file to the device

The new setting file **000.set** is created:

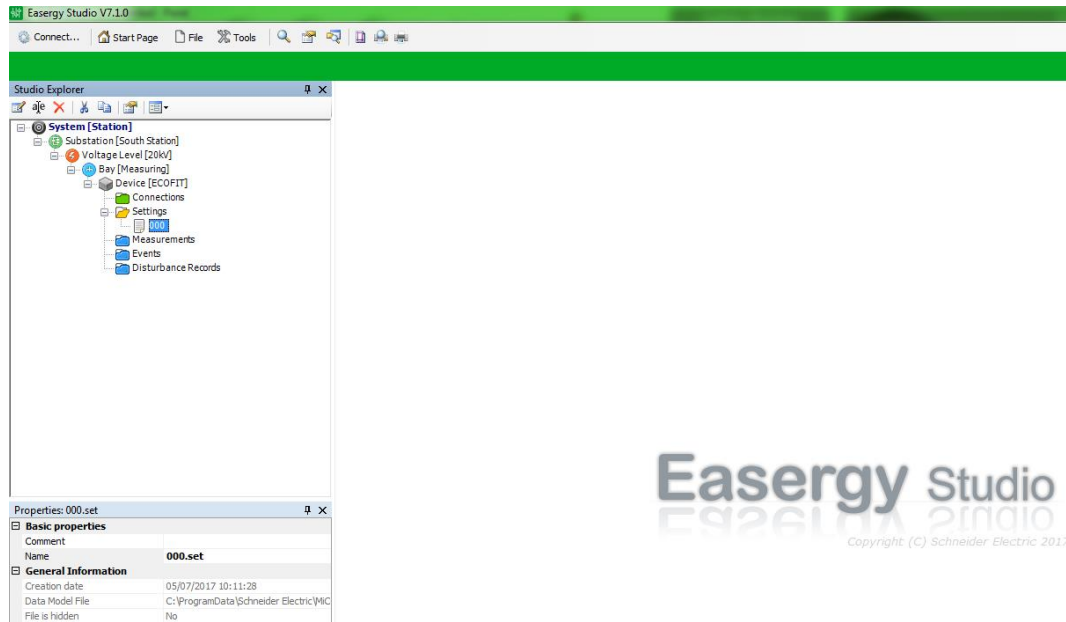


Figure 3-42: Default setting file 000.set

3.4.3 Troubleshooting USB connection

The virtual COM can be found in WINDOWS's "Device Manager" as shown below:

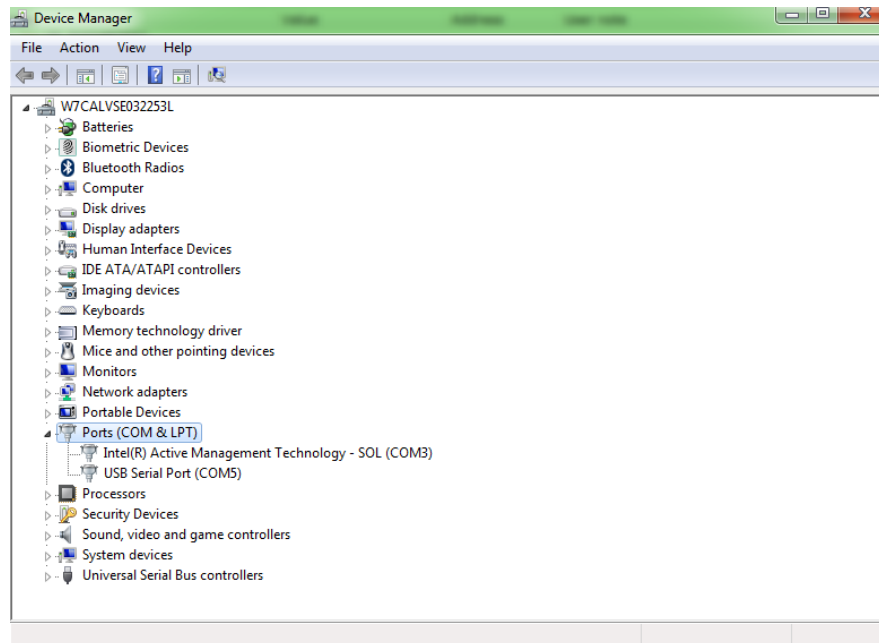


Figure 3-43: Ports in Device Manager

NOTE: If relay is connected but no USB Serial port is shown, it means that:

- USB drivers are not installed, or
- VCP (Virtual COM Port) option of USB Serial Converter is not selected.

On the Device Manager window, go to Universal Serial Bus controllers, as shown below:

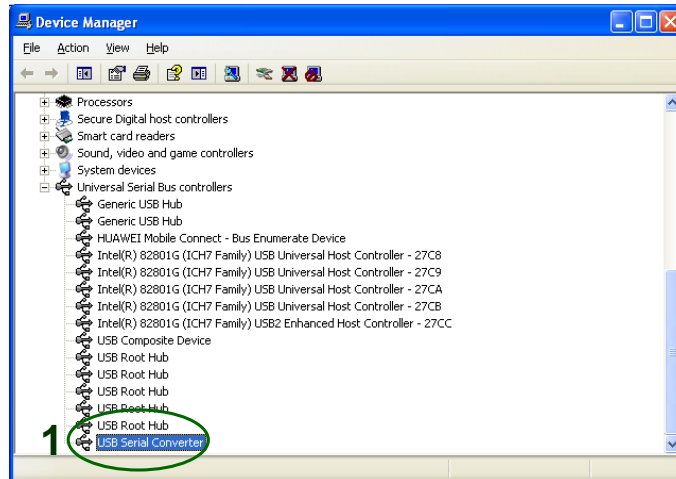


Figure 3-44 : USB serial converter

Check VCP option by right-click to open the contextual menu: Properties and Advanced:

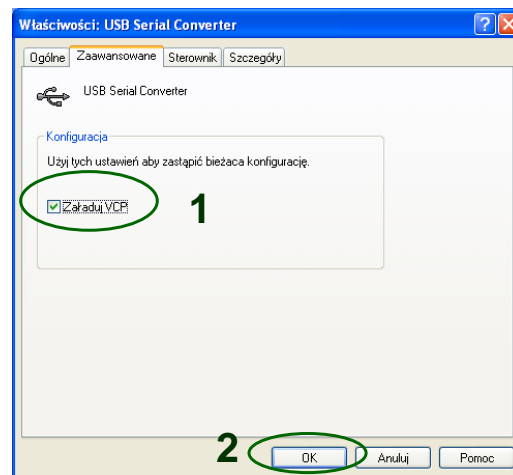



Figure 3-45: Enabling VCP

Unplug USB cable and plug in again. Restart Easergy Studio and repeat the procedure.

3.4.4 Presentation and analysis of disturbances

Reading and analysis of disturbance records are done using WaveWin.

To open the WaveWin with Easergy Studio 7.x.x, click on the Windows Start icon: . Go to All programs > Schneider Electric > Easergy Studio > WaveWin.

WaveWin can also be accessed from Easergy Studio, using the **Tools** menu.

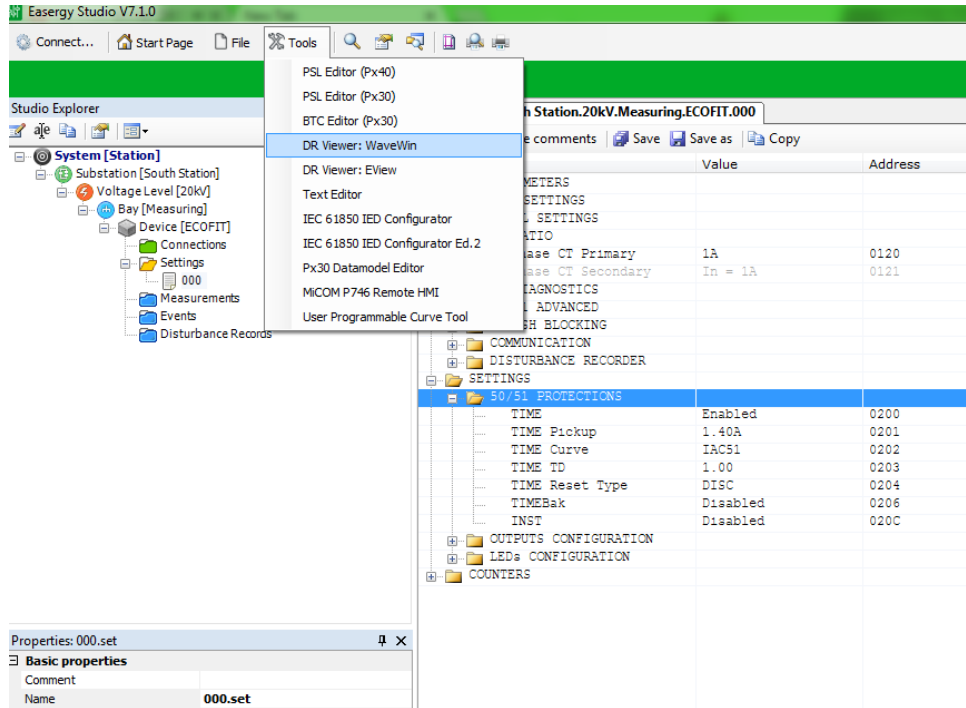


Figure 3-46: WaveWin access from Easergy Studio

The WaveWin File Manager is displayed (refer to the WaveWin User's guide to operate WaveWin).

3.5 COMPANY CONTACT INFORMATION

If you need information pertaining to the operation of the ECOFIT 50/51 product, please contact your local Schneider Electric agent or the After-Sales Service Department of Schneider Electric at:

Tel: 1-800-565-6699

Email: USEnergyTS@schneider-electric.com

Email: EAC_support@schneider-electric.com

Please provide the following information when contacting Schneider Electric:

- CORTEC code of the relay
- Serial number of the relay
- Schneider Electric order reference

Schneider Electric Worldwide Contact Centre:

Website: <http://www.schneider-electric.com/CCC>

4. TECHNICAL DATA

4.1 MECHANICAL SPECIFICATION OF THE ECOFIT 50/51 RELAY

4.1.1 Case

Design	Protection relay in S1 cradle
Weight	Approx. 2.25 kg

4.1.2 Terminals

Current Input and Output Relays Terminals

The ECOFIT 50/51 relay is a numerical relay pre-mounted on a cradle. Hence relay terminals are not accessible to the user. The relay connects to the circuit through its connecting fingers on the bottom of the cradle. These fingers connect to the case fingers via a connecting plug.

Local Communication

USB port

Connector: type mini B 5-pin male USB 2.0

USB Cable: USB 2.0, minimum 1P*28AWG/2C*24AWG, max: 2m

4.2 RATINGS

4.2.1 Current input

The values for 1A variant of the ECOFIT 50/51 relay are provided in the brackets.

Nominal frequency	50 or 60 Hz (selectable in menu)
Rated current	5 A (1 A)
RMS measurement range	40 Hz – 1 kHz
Fundamental harmonic measurement range	40 Hz – 70 Hz
Measurement range	0.5 – 200 A (0.1 – 40 A)
Nominal Burden	At 100% rated current
Active power:	< 1.5 W (without tripping condition)
Apparent power:	< 4.3 VA (without tripping condition)
Continuous thermal withstand	15 A (3 A) in the temperature range from -40°C to +60°C 10 A (2 A) in the temperature range from +60°C to +70°C
Short time thermal withstand, 1 sec	500 A (100 A) in the temperature range from -40°C to +60°C 350 A (100 A) in the temperature range from +60°C to +70°C
Short time thermal withstand, 2 sec	200 A (40 A) in the temperature range from -40°C to +70°C

Short time thermal withstand, 10 sec	150 A (30 A) in the temperature range from -40°C to +70°C
Frequency response	The relay keeps pickup tolerance in case of ±10% change from nominal 50/60 Hz frequency
Transient overreach	< 7 % with system time constants up to 40 ms

4.2.2 Output relays characteristics

Type	Normally open, voltage free contacts, AgSnO ₂
-------------	----------------------------------------------------------

Continuous carry ratings (not switched)	EN 60255-1: 2010	Maximum continuous current: 7 A Rated Voltage: 250 V ac/dc
Make, carry & break	EN 60255-1: 2010	<p>Resistive 120/240 Vac Make and carry 30 amperes for 0.2 seconds, carry 8 amperes for 2 minutes, 7 amperes continuously, and break 7 amperes.</p> <p>Resistive 125/250 Vdc Make and carry 30 amperes for 0.2 seconds, carry 8 amperes for 2 minutes, 7 amperes continuously, and break 0.3 ampere.</p> <p>Inductive 120/240 Vac and 125/250 Vdc Make and carry 30 amperes for 0.2 seconds, carry 8 amperes for 2 minutes, 7 amperes continuously, and break 0.3 ampere (L/R=40ms).</p>
Make & carry	ANSI/IEEE C37.90	30 A

4.3 INSULATION

Insulation resistance	EN 60255-27: 2014	Insulation resistance > 500 MΩ at 500 Vdc (Using only electronic/brushless insulation tester).
High Voltage (Dielectric) Withstand	EN 60255-27: 2014	2 kV rms AC, 1 minute: Between all case terminals connected together and the case Between all terminals of independent circuits with terminals on each independent circuit connected together
	ANSI/IEEE C37.90	1.5 kV rms AC for 1 minute, across open contacts of normally open output relays.
Impulse Voltage Withstand Test	EN 60255-27:2014	1.2 μs, / 50 μs, 5 kV Source Characteristics: 500 Ohm, 0.5 J. Common and differential mode: current inputs terminal block (excluding RS485), output relays.

Creepage Distances and Clearances	EN 60255-27:2014	Pollution degree 2, Overvoltage category III, Impulse test voltage 5 kV.
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4.4 EMC TESTS

1 MHz burst high frequency disturbance	EN61000-4-18: 2010	Level 3 2.5 kV Common-mode, 1.0 kV Differential-mode, Test duration: 2 s, Source impedance: 200 Ω
Surge withstand capability Damped oscillatory wave immunity	ANSI/IEEE C37.90.1 2012	2,5 kV transverse mode 2,5 kV common mode
Electrostatic discharge	EN61000-4-2: 2009	Level 3 8 kV discharge in air to all communication ports 6 kV point contact discharge to any part of the front of the product
Electrical fast transient or burst requirements	EN61000-4-4: 2012	Level 4 4 kV Burst frequency 5 kHz, 5/50 ns
Surge withstand capability Fast transient	ANSI/IEEE C37.90.1 2012	4 kV Burst frequency 5 kHz, 5/50 ns
Surge	EN61000-4-5: 2014	Level 4 1.2/50 μ s, Amplitude: 4 kV common mode Amplitude: 2 kV differential mode

<p>Radiated radiofrequency fields immunity</p>	<p>EN61000-4-3: 2010</p>	<p>Test field strength, frequency band: - 80 MHz to 1000 MHz: 10 V/m, - 1.4 GHz to 2.7 GHz: 10 V/m Test using Amplitude Modulation: 1 kHz / 80% sinus Spot frequencies: 80MHz, 160MHz, 380MHz, 450MHz, 900MHz, 1850MHz, 2150MHz 80 % Amplitude Modulation, 1kHz, 100% (duty cycle)</p>
<p>Radiated immunity from digital radio telephones</p>	<p>EN61000-4-3: 2010</p>	<p>10 V/m, 900 MHz 100% Amplitude Modulation, 200 Hz / 50% (duty cycle)</p>
<p>Radiated radiofrequency fields immunity</p>	<p>ANSI/IEEE C37.90.2</p>	<p>80MHz to 1000MHz: 20V/m 80 % Amplitude Modulation, 1kHz / 80% sinus Maximum field strength not less than 35V/m. Spot frequencies: 80MHz, 160MHz, 450MHz, 900MHz, 80 % Amplitude Modulation, 1kHz, 100% (duty cycle) 900MHz 100% Pulse Modulation, 200Hz, 50% (duty cycle).</p>
<p>Immunity to Conducted Disturbances Induced by Radio Frequency Fields</p>	<p>EN61000-4-6: 2014</p>	<p>10 V, 150 kHz to 80 MHz, 80% Amplitude Modulation, 1 kHz Spot frequencies: 27 MHz, 68 MHz</p>
<p>Power Frequency Magnetic Field Immunity</p>	<p>EN61000-4-8: 2010</p>	<p>Level 5 60Hz, 100 A/m - 1 minute for each position 60Hz, 1000 A/m - 3 seconds for each position</p>
<p>Pulse magnetic field immunity</p>	<p>EN61000-4-9: 2001</p>	<p>Level 5 6.4/16 μs, Magnetic pulse: 1000 A/m peak</p>

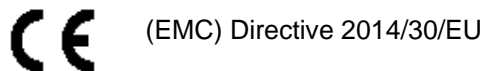
Radiated Emissions	EN55022: 2011 (CISPR 11)	Class A 30 MHz - 230 MHz, 40 dB μ V/m at 10 m measurement distance 230 MHz - 1 GHz, 47 dB μ V/m at 10 m measurement distance
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4.5 ENVIRONMENT

Ambient Temperature Range	EN60255-1: 2010 EN60068-2-1: 2007 EN60068-2-2: 2007	Operating temperature range: -40°C to 70°C (LCD operation/readability functional between -20°C to +60°C) Storage and transit: -40°C to +70°C
Ambient Humidity Range	EN60068-2-78: 2013	21 days at 93% relative humidity and +40°C
	EN60068-2-30: 2005	Damp heat cyclic, six (12 + 12) hour cycles, 93% RH, +25 to +55°C
Vibration Test	EN60255-21-1: 1995	Response Class 1 Endurance Class 1
Shock and Bump	EN60255-21-2: 1995	Shock response Class 1 Shock withstand Class 1 Bump Class 1
Seismic	EN60255-21-3: 1995	Class 2

4.6 EU Directive

4.6.1 EMC compliance

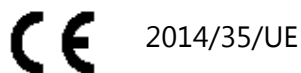


Compliance with the European Commission's EMC Directive.

Product Specific Standards were used to establish conformity:

- EN 60255-26:2013
- EN 60255-1: 2010

4.6.2 Product safety



Compliance with the European Commission's Low Voltage Directive. Compliance is demonstrated by reference to generic safety standards:

– EN 60255-27:2014

4.7 DEVIATIONS OF THE PROTECTION ELEMENTS

Glossary

- I : Measured current
- I_s : setting value for TIME, TIMEBak, INST pickup
- DT : Definite time
- IDMT : Inverse definite minimum time

If the relay starts with a minimum pre-load of 1 A for 1 second in 5 A variant (0.2 A for 1 second in 1 A variant), accuracies are as follows:

Variant	Element	Range	Pickup	Reset	Time deviation
1 A	TIME	0.2 to 38 A	DT: $I_s \pm 5\% \pm 0.01$ A IDMT: $1.1I_s \pm 5\% \pm 0.01$ A	$0.95 I_s \pm 5\% \pm 0.01$ A $0.95 \times (1.1I_s \pm 5\% \pm 0.01$ A)	$\pm(2\% + 40\text{ms})$ $\pm(5\% + 40\text{ms})$ (acc. to IEC60255-151)
5 A	TIME	1.0 to 190 A	DT: $I_s \pm 5\% \pm 0.05$ A IDMT: $1.1I_s \pm 5\% \pm 0.05$ A	$0.95 I_s \pm 5\% \pm 0.05$ A $0.95 \times (1.1I_s \pm 5\% \pm 0.05$ A)	$\pm(2\% + 40\text{ ms})$ $\pm(5\% + 40\text{ ms})$ (acc. to IEC60255-151)

Variant	Element	Range	Pickup	Reset	Time deviation
1 A	TIMEBak	0.4 to 38 A	DT: $I_s \pm 5\% \pm 0.01$ A IDMT: $1.1I_s \pm 5\% \pm 0.01$ A	$0.95 I_s \pm 5\% \pm 0.01$ A $0.95 \times (1.1I_s \pm 5\% \pm 0.01$ A)	$\pm(2\% + 40\text{ms})$ $\pm(5\% + 40\text{ms})$ (acc. to IEC60255-151)
5 A	TIMEBak	2.0 to 190 A	DT: $I_s \pm 5\% \pm 0.05$ A IDMT: $1.1I_s \pm 5\% \pm 0.05$ A	$0.95 I_s \pm 5\% \pm 0.05$ A $0.95 \times (1.1I_s \pm 5\% \pm 0.05$ A)	$\pm(2\% + 40\text{ ms})$ $\pm(5\% + 40\text{ ms})$ (acc. to IEC60255-151)

Variant	Element	Range	Pickup	Maximum time to trip
1 A	INST	1.0 to 38 A	$I_s \pm 5\% \pm 0.01$ A	≤ 40 ms (for injections $\geq 1.2 I_s$)
5 A	INST	5.0 to 190 A	$I_s \pm 5\% \pm 0.01$ A	≤ 40 ms (for injections $\geq 1.2 I_s$)

In case of no pre-load (e.g. ground fault application), the boot time needs to be added to the trip time calculation for any protection element. The boot time depends on the overcurrent fault current value and is expressed in below table (values for 1 A variant relay are provided in the brackets):

Overcurrent fault current [A]	1.0 (0.2)	2.0 (0.4)	3.0 (0.6)	≥ 4.0 (≥ 0.8)
Maximum boot time [ms]	65	40	35	25

Example:

INST pickup threshold = 5A; I_{fault} = 10A; Ground application, i.e. no pre-fault current

Maximum time to trip = INST maximum time to trip (40 ms) + Maximum boot time (25 ms) = 65 ms

Note: In case of pre-fault current, if Inrush Blocking function is enabled, an additional delay of 35 ms needs to be added to the tripping time calculation.

4.8 DEVIATIONS OF MEASUREMENTS

Measurement	Deviation
Measured current	±2% at rated current

4.9 PROTECTION ELEMENTS

4.9.1 Overcurrent protection element

There are 3 independent overcurrent protection elements included in ECOFIT 50/51 relay:

- TIME - time overcurrent element
- TIMEBak – time (backup) overcurrent element
- INST – instantaneous overcurrent element

The INST element trip instantaneously on an overcurrent pickup. For TIME and TIMEBak elements, there is a choice of Definite Time (DT) or one of the 31 pre-defined Inverse Definite Minimum Time (IDMT) curves. The equations and graphical illustration of these curves are provided in OVERCURRENT CURVES chapter.

TIME protection element is fixed to RL1 and this assignment cannot be removed. It can optionally be assigned to RL2. TIMEBak and INST protection elements can be assigned either to RL1 or RL2 or both.

Each protection element could be blocked by inrush blocking scheme, explained in the next section.

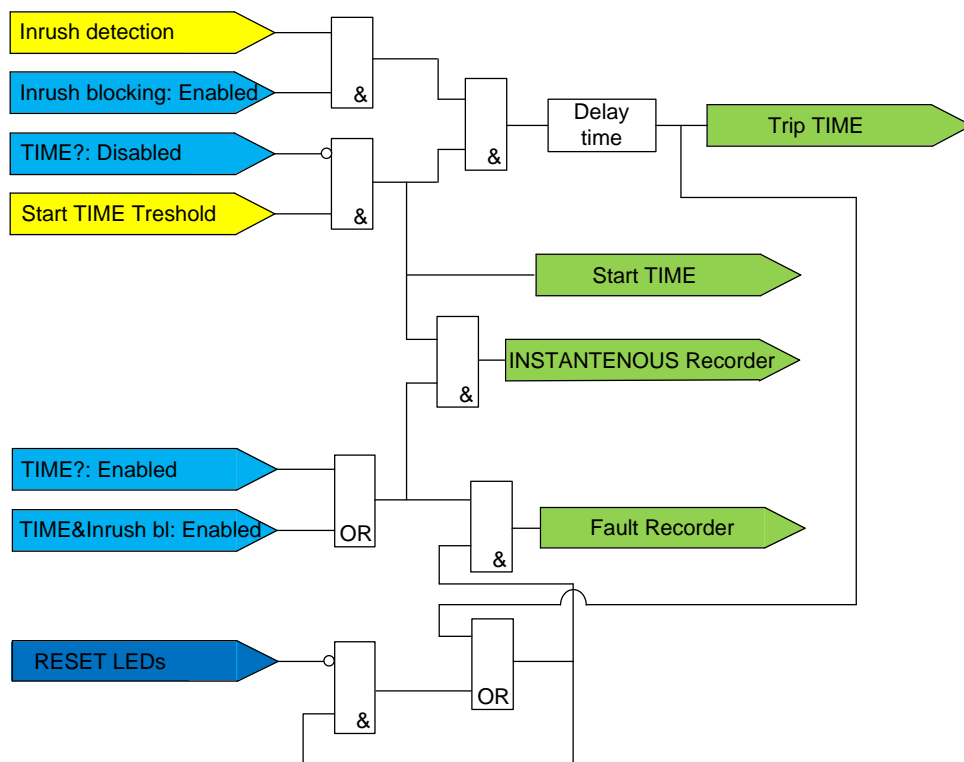


Figure 4-1: Overcurrent protection logic diagram

The values for 1A variant of the ECOFIT 50/51 relay are provided in the brackets.

TIME TOC (50/51)	Description
TIME	Time overcurrent element
Pickup setting range	1 A – 190 A (0.2 A – 38 A)
Relay output	RL1 (fixed) RL2 can be assigned additionally
Delay type	DT, GE (IAC51, IAC53, IAC55, IAC66, IAC77), Basler (I1, I2, V1, V2, S1, S2, L1, L2, E1, E2), ABB (CO-2, CO-5, CO-7, CO-8, CO-9, CO-11), SEL (U1, U2, U3, U4, U5), IEEE (MI, VI, EI) and SE (Overload)
DT range	0.05 - 200
Reset type	DISC, Inst
Magnetic flag	TIME flag

TIMEBak TOC (50/51)	Description
TIMEBak	Time (back-up) overcurrent element
Pickup setting range	2 A – 190 A (0.4 A – 38 A)
Relay output	RL1 or RL2
Delay type	DT, GE (IAC51, IAC53, IAC55, IAC66, IAC77), Basler (I1, I2, V1, V2, S1, S2, L1, L2, E1, E2), ABB (CO-2, CO-5, CO-7, CO-8, CO-9, CO-11), SEL (U1, U2, U3, U4, U5), IEEE (MI, VI, EI) and SE (Overload)
DT range	0.05 - 200
Reset type	DISC, Inst
Magnetic flag	TIME flag

INST IOC (50)	Description
INST	Instantaneous overcurrent element
Pickup setting range	5 A – 190 A (1 A – 38 A)
Relay output	RL1 or RL2
Magnetic flag	INST flag

4.9.2 Reset characteristics

TIME, TIMEBak	Description
Inst	The protection element resets instantaneously if the current falls below 95% of the pickup setting.
DISC	Simulates the disc of electromechanical relay; the reset starts when the current falls below 95% of pickup setting.

4.9.3 Inrush blocking function

In applications where the sensitivity of overcurrent thresholds need to be set below the prospective peak inrush current, the inrush blocking function can be used to block the overcurrent stages.

The inrush blocking function would block the protection elements ONLY if **1. harmonic** is selected for the Measurement Method (GLOBAL SETTINGS/LOCAL SETTINGS/Meas. Method).

The Inrush blocking function measures the ratio of second to fundamental harmonic (1. Harmonic) of current. If the 2nd harmonic ratio is higher than the settable threshold, the inrush blocking function will block the *selected* overcurrent elements. Inrush blocking function resets the selected protection function timer.

The Inrush Blocking function blocks the selected protection stages every time inrush conditions are present (Ratio of 2nd Harmonics measured greater than Inrush H2 set ratio), and will be active at least for the duration of Inrush Reset Time. This timer defines the minimum duration of overcurrent threshold inhibition (0-200 s, settable). This timer starts as soon as operating inrush current exceed the threshold.

If the inrush condition lasts less than the set value for Inrush Reset Time, the selected overcurrent function will be inhibited for the duration of Inrush Reset Time.

If the inrush condition lasts longer than the set value for Inrush Reset Time, the selected overcurrent function will remain inhibited as long as the inrush condition is present.

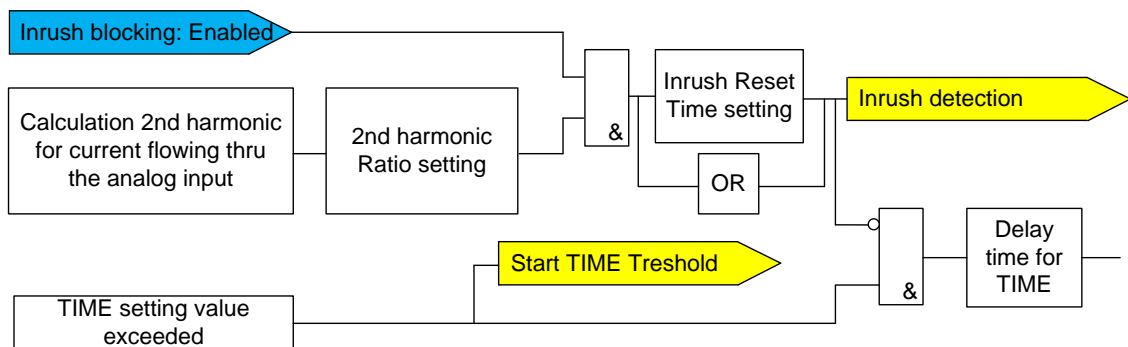


Figure 4-2: Second harmonic blocking diagram for the TIME, TIMEBak and INST protection element

Inrush blocking	Description
Blocking inrush	Inrush blocking using 2 nd harmonic
Protection element to block	Fully configurable (TIME, TIMEBak, INST)
2 nd Harmonic Ratio	10 – 50%

Inrush blocking function introduces an additional delay of approximately 35 milliseconds to the tripping time, in case of a pre-load.

4.9.4 IDMT interlock by DT

This function blocks IDMT (Inverse Definite Minimum Time) tripping signal if any DT (Definite Time) protection element is started.

The function works if IDMT curve is selected for TIME protection element and DT is selected for TIMEBak element, or vice-versa. In such a case, the IDMT tripping signal will be blocked in case of a pickup of the DT element. This helps to ensure that minimum tripping time equal to the DT stage delay time when both functions pickup.

4.10 PERIPHERAL DEVICES

4.10.1 LCD

The ECOFIT 50/51 protection relay is equipped with 16-character by 2-line alphanumeric liquid crystal display (LCD). A back-light feature enables when the front panel keys are used. The LCD is readable in a temperature range of -20°C to +60°C.

4.10.2 Magnetic flag indicators

Magnetically latched flag indicators are provided in ECOFIT 50/51 protection relay. The flag indicators are operable from the minimum operating current of the relay. The flags are latched. Flags would reset by plugging a power source to USB port (power bank or PC) and pressing the “C” button.

Flag indicator	Description
TIME	Fixed to trip signal of TIME and TIMEBak protection elements.
INST	Fixed to trip signal of INST protection element.

4.10.3 Output Relays

Two output relays are provided in ECOFIT 50/51 for tripping and pickup purposes. The minimum current levels required for the operation of output relays are presented in below table:

Relay output	Minimum current level required for the operation
RL1	1A for 5A variant (0.2A for 1A variant)
RL2	2A for 5A variant (0.4A for 1A variant)

The assignment of protection elements to relay outputs is as per below table:

Functions	Description
TIME Trip	Fixed to RL1, RL2 can be assigned additionally
TIMEBak Trip	Freely configurable (RL1 and/or RL2)
INST Trip	Freely configurable (RL1 and/or RL2)

TIME Start	Freely configurable (RL1 and/or RL2)
TIMEBak Start	Freely configurable (RL1 and/or RL2)
INST Start	Freely configurable (RL1 and/or RL2)

4.10.4 LEDs

Seven LEDs are provided in ECOFIT 50/51 protection relay. Two of them have specific fixed functionalities and the rest are freely configurable. The table presents the possibilities of assignments for LEDs. All LEDs are off if the current is below operating current threshold.

Functions	Description
Active (Watchdog)	Fixed to LED7 (Green) This LED blinks if there is an detected issue in any of the following relay (HW or SW) components: microcontroller- no application running memory – detected application error causing no possibility of sampling (measurement) power supply watchdog function
Manual Trip Mode	Fixed to LED1 (Orange)
TIME Trip	Configurable to LEDs 2-6 (Red)
TIMEBak Trip	Configurable to LEDs 2-6 (Red)
INST Trip	Configurable to LEDs 2-6 (Red)
Latched LEDs	Configurable on LEDs 2-6 (Red) This setting defines which LEDs are latched.
TIME Start	Configurable to LEDs 2-6 (Red)
TIMEBak Start	Configurable to LEDs 2-6 (Red)
INST Start	Configurable to LEDs 2-6 (Red)
Detected alarms	Configurable to LEDs 2-6 (Red) Detected alarm LED illuminates if: One of the counters in CB diagnostics reaches its threshold The backup capacitor has been fully discharged and the internal clock is reset A hardware detected issue has been issued by the internal supervision system
Remote CTRL mode	Configurable to LEDs 2-6 (Red)

4.10.5 Real time clock with back-up capacitor

Real time clock can retain of time and date up to 36 hours without load. If the no-load period is shorter than 36 hours, the ECOFIT 50/51 relay keeps actual time and date; otherwise, the relay loses actual time and date and resets to January 1st, 2015. Following a time reset, a time lost indication logs in Alarm Recorder.

It takes 10 minutes for the backup capacitor to completely charge from a fully discharged state.

4.11 DIAGNOSTIC FUNCTIONS

4.11.1 CB Diagnostics

CB diagnostic function counts CB open operations and interrupted current value. If the set thresholds are reached, the relay displays a detected alarm indication. The starting values for continuation of historical count can be introduced to the relay under COUNTERS menu.

CB Diagnostics	Description
Max CB Open	Value from 1 to 50000
Max Sum AMPS^n	Value from 0 to 6553

4.12 RECORDING FUNCTIONS

4.12.1 Event records

Capacity	200 events
Time-tag	1 millisecond
Triggers	Any enabled protection element (start & trip) Setting changes Load level events (Passing thresholds of 0.2 and 0.4 rated current)

4.12.2 Overcurrent fault records

The overcurrent fault records are only accessible through Easergy Studio software.

Capacity	20 overcurrent faults
Time-tag	1 millisecond
Triggers	Any trip signal from enabled protection elements
Data	Overcurrent fault date/time Started/Tripped protection element Overcurrent fault measurements (in Amp prim, RMS)

4.12.3 Instantaneous recorder

The instantaneous records are accessible via relay HMI.

Capacity	5 starting information (any protection element)
Time-tag	1 millisecond
Triggers	All enabled protection element
Data	Date/Time Protection element

4.12.4 Alarm records

Capacity	5 detected alarm information
Time-tag	1 millisecond
Triggers	Time Lost – the RTC capacitor fully discharges and the internal clock resets to default value CB No Diagnostic – maximum number of CB open operations reached CB Current Diag. – maximum broken current value of the CB reached Hardware detected alarms – offset detection or real-time clock failure indication
Data	Date/Time Detected alarm origin

4.12.5 Disturbance records

The disturbance recorder logs real current values over a predefined time period. The oscillography can be viewed and analyzed using WaveWin tool available in Easergy Studio setting software package.

Capacity	10 records, each up to 4 seconds
Triggers	Any enabled protection element
Data	AC current input values Output contacts status Frequency value
Pre-Trig Time	Configurable from 0.1 to 2 seconds
Post-Trig Time	Configurable from 0.1 to 2 seconds
Trig-Init	On Start, On Start & Trip, On Trip of all protection elements

4.13 COMMUNICATION

The ECOFIT 50/51 protection relay is also equipped with a USB communication port located on the front panel of the relay. This port may be used to set the parameters by Easergy Studio software, extract records from the relay, and power-up the relay HMI and reset magnetic flags.

Physical Link	Connectors	Data Rate	Comms. mode	Protocol
USB 2.0	type mini B male	Fixed at 115.2 Kbits/s	Data Bit:8 Stop bit: 1 Parity: None Address: 1	Modbus RTU

4.14 COUNTERS

The relay counters are only accessible from the relay HMI.

4.14.1 Control counter

The control counter counts the number of CB open commands received from SCADA system – Wiring to SCADA is not possible on the current version of ECOFIT 50/51 relay.

4.14.2 Overcurrent fault counter

The overcurrent fault counter counts the number of CB open commands generated by protection elements.

4.14.3 CB operation counter

This counter counts the number of CB open operations. The starting value can be introduced to continue an old count from previous installation.

4.14.4 Breaking current counter

This counter counts the breaking current value for each operation counted by CB open operation counter. The count is based on the maximal current value recorded by overcurrent fault recorder. The values are summarized and expressed in Amp or Amp². The starting value can be introduced to continue an old count from previous installation.

5. SETTINGS

5.1 GENERAL INFORMATION

The ECOFIT 50/51 relay should be configured with appropriate settings based on the system and its application. The settings are described in the following order: OP PARAMETERS, GLOBAL SETTINGS, SETTINGS and COUNTERS.

All current threshold settings are secondary current values.

Easergy Studio 7.0.0 (or higher) needs to be used to download and upload configuration setting via the relay's USB port.

If a protection element is disabled in the SETTINGS, its corresponding settings will not be visible in the following setting groups:

- Protection element settings
- Output settings
- LED settings

The relay's menu structure is also accessible from the relay's HMI, as follows:

- *DEFAULT DISPLAY*
- *DETECTED ALARM STATUS*
- *RECORDS*
 - *OVERCURRENT FAULT RECORDS*
 - *ALARM RECORDS (CB DIAGNOSTICS)*
 - *INSTANTANEOUS RECORDS*
 - *COUNTERS*
 - *OVERCURRENT FAULT COUNTER*
 - *CB MONITORING COUNTER*
- *SETTINGS*
- *50/51 PROTECTION*
 - *OUTPUTS CONFIGURATION*
 - *LEDS CONFIGURATION*
- *GLOBAL SETTINGS*
 - *GENERAL*
 - *CT RATIO*
 - *CB DIAGNOSTICS*
 - *50/51 ADVANCED*
 - *INRUSH BLOCKING*
 - *COMMUNICATION*
 - *DISTURBANCE RECORDER*
- *SETTING CHANGE MODE*
- *OP PARAMETERS*
- *MEASUREMENTS*

5.2 OP PARAMETERS

The information in this section is read only.

Menu Text	Default Setting	Available Settings
Description	ECOFIT 50/51 5A (ECOFIT 50/51 1A)	Read only
This cell shows the type of relay.		
Hardware Type	In = 5A (In = 1A)	Read only
This cell shows the hardware version.		
Firmware Version	1.A.00	Read only
This cell shows the software (firmware) version.		
Phase Range (CT_SEC)	In = 5A; 1-190A (In = 1A; 0.2-38A)	Read only
This cell shows the secondary nominal current of the relay as well its setting range.		
Nominal Frequency	60 Hz	Read only
This cell shows the nominal frequency setting.		

The following cells are only accessible from the relay HMI:

Serial Number	000000	Read only
This cell shows the relay serial number.		
Date	01/01/15	01/01/00 – 31/12/99
This cell is used to set the date of the internal clock.		
Time	00:00:00	00:00:00 – 23:59:59
This cell is used to configure the time of the internal clock. Notes: The back-up capacitor can retain the date/time of the relay for 36 hours under no-current condition. After a complete discharge of the back-up capacitor, the date/time of the relay is reset to 01/01/15 00:00:00. Therefore, events following the clock reset will be time-tagged with this date/time. When the back-up capacitor is completely discharged, it takes less than 10 minutes for a complete recharge from secondary CT current.		

5.3 GLOBAL SETTINGS

5.3.1 General

Menu Text	Default Setting	Available Settings
Language	English US	English US
This cell shows the language of the menu.		
Date format	MM/DD/YY	MM/DD/YY DD/MM/YY
This cell is used to select the format for date on time in the relay HMI.		
Clock Format	12H	12H, 24H
This cell is used to select the format of the clock in the relay HMI.		
Default Display	Amp prim	Amp prim, Amp sec
This cell controls whether the measured current is displayed in primary or secondary value.		
Reset Signaling	Manual only	Manual only Start protection
This cell sets the resetting method of latched LEDs and flags. <i>Manual only</i> – Resetting latched LEDs and flags via manual reset (C clear key, USB) <i>Start protection</i> – Resetting latched LEDs and flags upon any protection start or via manual reset		
Reset Trip Info	Manual only	Manual only Start Protection
This cell sets the resetting method of latched outputs in the menu. <i>Manual only</i> – Resetting latched output contacts by manual reset (C clear key, USB) <i>Start protection</i> – Resetting latched output contacts upon any protection start or via manual reset		
Nominal Frequency Set	60Hz	60Hz, 50Hz
This cell sets the nominal frequency of the power system.		
Meas Method	1. harmonic	1. harmonic, True RMS
Configuration of protection criteria: <i>1. harmonic</i> – protection elements use fundamental harmonic component of the current <i>True RMS</i> – protection elements use True RMS value of the current		
Phase Description	Disabled	Disabled, Phase A, Phase B, Phase C, E/GND
This cell sets the phase description on the default display of the relay.		

5.3.2 CT ratio

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
Phase CT Primary	5 A (1 A)	1	30000	1
This cell sets the primary current rating of the current transformer.				
Phase CT Secondary	In = 5 A or In = 1 A	Read Only		
This cell shows the secondary nominal current of the relay. This value is not configurable as it is defined in the hardware selection of the relay.				

5.3.3 CB diagnostics

Menu Text	Default Setting	Available Settings
CB Diagnostics Enablement	Disabled	Disabled, Enabled
This setting enables or disables CB diagnostics function. If enabled, the following setting menu is be made visible.		
Max CB Open	5000	00000-50000
Sets the detected Alarm threshold for the number of open operations of the circuit breaker. If the threshold is reached, the detected Alarm is recorded in detected Alarm records. The counter considers trip signals from protection functions. A starting value different than 0 can be introduced in COUNTERS/CB Open Number to continue an existing count.		
Max Sum AMPS^n	0.1 MA^n	0000.0 – 6553.0 MA^n
Sets the detected alarm threshold for the summation of current (in Amps or square Amps) interrupted by the circuit breaker. If the threshold is reached, the detected Alarm is recorded in detected Alarm records. A starting value different than 0 can be introduced in COUNTERS/CB Amps Value to continue an existing count.		
AMPS' n=	1	1, 2
This cell sets the exponent for the current summation: I OR I ² .		

5.3.4 50/51 advanced

Menu Text	Default Setting	Setting Range
IDMT interlock by DT	No	No, Yes
<p>If set to Yes, IDMT stage is blocked by the start of the DT stage. See Technical Chapter for details.</p> <p>Note: INST protection element is not affected by this setting.</p>		

5.3.5 Inrush blocking

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
Inrush Blocking Enablement	Disabled	Disabled, Enabled		
<p>If Enabled, the Inrush Blocking function will block the selected protection elements once the 2nd Harmonic to fundamental harmonic ratio of the measured current exceeds the threshold setting. If Disabled, the following settings will be invisible.</p>				
2 nd Harmonic Ratio	20%	10%	50%	0.1%
<p>Sets the value for the 2nd harmonic to fundamental harmonic threshold ratio.</p>				
Inrush Reset Time	0.00 s	0.0 s	200.0 s	0.01 s
<p>This setting provides a reset delay for the Inrush Blocking signal once the 2nd to fundamental harmonic ratio falls below the threshold.</p> <p>Note: Typically, the Reset Time should be set to 0 ms since second harmonic blocking can cause an additional tripping delay. If unwanted tripping is caused by the inrush phenomenon, then this value can be increased.</p>				
Blocking of	TIME	TIME, TIME&INST, TIME&TIMEBak, TIME&TIMEBak&INST, TIMEBak&INST, TIMEBak, INST		
<p>Select the protection elements that will be blocked by Inrush Blocking function.</p>				

5.3.6 Disturbance recorder

The relay can archive up to 10 disturbance records. The records can be extracted and viewed using WaveWin tool, accessible through Easergy Studio software. These records are not displayed on the relay's HMI. The Pre-Trig and Post-Trig times of the records are configurable. The settings do not affect the maximum number of records, which is 10.

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
DR Pre-Trig Time	1.00 s	0.10 s	2.00 s	0.01 s
This cell sets the pre-overcurrent fault period in each record. Note: If there is no pre- overcurrent fault current, the pre-triggering period is not recorded due to a lack of power (no current) condition.				
DR Post-Trig Time	1.00 s	0.10 s	2.00 s	0.01 s
This cell sets the post-overcurrent fault period in each record. Note: If the Circuit Breaker opens successfully, the post-triggering period is not recorded due to a lack of power (no current) condition.				
DR Trig Init	on Trip.	on Trip on Start & Trip on Start		
Setting for the triggering criteria: on Trip. – The recorder is triggered only when a protection element trips. on Start & Trip. – The record is triggered when a protection element starts. on Start – The recorder is triggered only when a protection element starts. Note: If the overcurrent fault duration is longer than Post-Trig time 10 seconds, a second disturbance record will be created to cover the extended period.				

5.4 SETTINGS

5.4.1 50/51 protections

The ECOFIT 50/51 relay provides non-directional single phase overcurrent protection with independent time-delay and instantaneous characteristics.

The first two overcurrent stages have time-delayed characteristics. Inverse definite minimum time (IDMT) and definite time (DT) could be selected in these stages. The third stage is for Instantaneous protection only. **Default settings are given in the table below for ECOFIT 50/51 5A version (values for 1A are in brackets).**

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
TIME	Enabled	Enabled, Disabled		
Setting to disable or enable the TIME protection element				
TIME Pickup	7.00 A (1.40 A)	1.00 A (0.20 A)	190 A (38 A)	0.01 A
Pick-up setting for the TIME protection element in secondary Amps				
TIME Curve	IAC51	DT, IAC51, IAC53, IAC55, IAC66, IAC77, S1, L1, M, I1, V1, E1, S2, L2, I2, V2, E2, U1, U2, U3, U4, U5, CO-2, CO-5, CO-7, CO-8, CO-9, CO-11, IEEE MI, IEEE VI, IEEE EI, Overload		
Setting for selecting the tripping characteristic curve for the TIME protection element				
TIME Delay	1 s	0.05 s	200 s	0.01 s
Setting for time delay when DT (definite time) curve type is selected for the TIME protection element				
TIME TD	1	0.02	20	0.01
Setting for time dial when IDMT (inverse time) curve types are selected for the TIME protection element. The range of the acceptable value for this cell depends on the type of the IDMT curve.				
TIME Reset Type	DISC	Inst (Instantaneous), DISC (integrating disc)		
Setting for reset type of the TIME protection element Inst – the element resets in approximately 16 ms DISC – the element resets as per reset equation				
TIMEBak	Disabled	Enabled, Disabled		
Setting to disable or enable the TIMEBak (backup) protection element				
TIMEBak Pickup	10.00 A (2.00 A)	2.00 A (0.40 A)	190 A (38 A)	0.01 A
Pick-up setting for the TIMEBak (backup) protection element in secondary Amps				
TIMEBak Curve	IAC51	DT, IAC51, IAC53, IAC55, IAC66, IAC77, S1, L1, M, I1, V1, E1, S2, L2, I2, V2, E2, U1, U2, U3, U4, U5, CO-2, CO-5, CO-7, CO-8, CO-9, CO-11, IEEE MI, IEEE VI, IEEE EI, Overload		
Setting for the tripping characteristic for the TIMEBak (backup) protection element				

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
TIMEBak Delay	2 s	0.05 s	200 s	0.01 s
Setting for the time delay when the DT (definite time) curve type is selected for the TIMEBak protection element				
TIMEBak TD	1 s	0.02 s	100 s	0.01 s
Setting for the time dial when IDMT (inverse time) curve types are selected for the TIMEBak protection element				
TIMEBak Rst Type	DISC	Inst (Instantaneous), DISC (integrating disc),		
Setting for selecting the reset type of the TIMEBak protection element				
INST	Enabled	Enabled, Disabled		
Setting to disable or enable the INST (Instantaneous) protection element				
INST Pickup	40.00 A (8.00 A)	5.00 As (1.00 A)	190 A (38 A)	0.01 A
Pick-up setting for the INST (Instantaneous) protection element in secondary Amps				

5.4.2 Outputs configuration

Output settings define which signals are mapped to the ECOFIT 50/51 output relays.

Menu Text	Default Setting	Setting Range – Each digit
TIME Output	Output 1	Output 1, Output1 & 2
TIME trip signal is pre-fixed to output RL1; This assignment cannot be changed TIME can be assigned to output RL2 as well		
TIMEBak Output	No	No, Output 1, Output 2, Output 1 & 2
TIMEBak trip signal can be assigned to outputs RL1 and/or RL2.		
INST Output	Output 2	No; Output 1, Output 2, Output 1 & 2
Instantaneous trip signal can be assigned to RL1 or/and RL2. The default setting is RL2.		
Start TIME Output	No	No, Output 1, Output 2, Output 1 & 2
Start for TIME protection element can be assigned to RL1 and/or RL2. The contact would close if the current value is: above the threshold value, in case of a DT curve above %110 of the threshold value, in case of a IDMT curve		
Start TIMEBak Output	No	No, Output 1, Output 2, Output 1 & 2
Start for TIMEBak protection element can be assigned to RL1 and/or RL2. The contact would close if the current value is: above the threshold value, in case of a DT curve above %110 of the threshold value, in case of a IDMT curve		
Start INST Output	No	No, Output 1, Output 2, Output 1 & 2
Start for INST protection element can be assigned to RL1 and/or RL2.		

5.4.3 LEDs configuration

There are five configurable LEDs (2 – 6) in the relay. Matrix configuration allows free mapping of any function to each LED. LED1 (Orange) and LED7 (Green) are nonconfigurable and are assigned for Trip Mode and Active indication respectively. Configurable LEDs are red when activated.

Menu Text	Default Setting	Setting Range – Each digit
Description of bits:	LED: 2,3,4,5,6	
TIME LED	No (000000)	0–1
Each LED can be assigned to trip signal of TIME protection element.		
TIMEBak LED	No (000000)	0–1
Each LED can be assigned to trip signal of TIMEBak protection element		
INST LED	No (000000)	0–1
Each LED can be assigned to trip signal of INST(Instantaneous) protection element		
Latched LEDs	No (000000)	0–1
Each LED can be configured as latched or not-latched. If a LED is set as latched, it is ON until it is reset Manually or by a protection element start (See reset signaling line for more details). Note: In either case, the LEDs do not activate under no current condition.		
Start TIME LED	No (000000)	0–1
DT curve: the assigned LED activates if the current exceeds the TIME pick-up level. IDMT curve: the assigned LED activates if the current exceeds 1.1 times the TIME pick-up level.		
Start TIMEBak LED	No (000000)	0–1
DT curve: the assigned LED activates if the current exceeds the TIMEBak pick-up level. IDMT curve: the assigned LED activates if the current exceeds 1.1 times the TIMEBak pick-up level.		
Start INST LED	No (000000)	0–1
The assigned LED activates if the current exceeds the INST pick-up level.		
Detected Alarms LED	No (000000)	0–1
The assigned LED activates if a detected Alarm has been generated. Below is the list of the detected alarms: Time Lost – the outage duration exceeded 36 hours and the real-time clock of the relay has been reset CB Nb Diagnostic – the number of CB operations reached the threshold CB Current Diag – the sum of currents interrupted by the CB reached the threshold Hardware issue indication – there is a detected offset issue, or RTC is not working correctly		

5.5 COUNTERS

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
CB Open Number	0	1	50000	1
A starting value for existing number of CB operation can be entered in this cell				
CB Amps Value	0.0 MA	0	6553 MA	0.100
A starting value for existing summation of current of CB can be entered in this cell				

5.6 MANUAL TRIP MODE

When Manual Trip Mode is activated, the TIME and INST Manual Trip keys on the faceplate of the relay are enabled. Pressing TIME Manual Trip key activates the TIME flag indicator and the output contact(s) assigned to TIME and TIMEBak protection elements. Pressing the INST Manual Trip key activates the INST flag indicator and the output contact(s) assigned to INST protection element. For both TIME and INST elements, output(s) will stay activated until the Manual Trip button is released. Manual Trip Mode function works uniquely if the relay is powered via the front USB port and is in Full Access Mode. The Manual Trip mode works for the enabled protection elements only. If no protection element is activated, the Manual Trip keys do not trigger the trip flag indicators.

Menu Text	Default Setting	Available Settings
Manual Trip Mode	Disabled	Disabled, Enabled
This setting enables Manual Trip Mode in the relay, and activates the TIME and INST Manual Trip keys on the faceplate.		

Note: The enabled protection functions are active in manual trip mode.

5.7 SETTING CHANGE MODE

The setting change mode allows user to configure the settings of the relay via relay's HMI.

To change the relay settings by relay's HMI, it is required to set **Edit Setting Mode** to **Full access** mode. LEDs 2 to 6 will flash continuously to indicate that the relay is in **Full access** mode and all settings will be accessible for view/edit.

In the **View access** mode, access to the menu cells is granted only for viewing purpose. No setting changes are permitted in this mode. There is no indication of LEDs for **View access** mode.

Menu Text	Default Setting	Available Settings
Edit Settings?	No password, Full access enabled	0000 – 9999
This cell is used to switch the ECOFIT 50/51 to Edit Settings to allow setting changes		
Setting Change		View access Full access
This cell displays the access mode		
Change Password		0000 – 9999
This cell is displayed if the password is entered. To change password, it is required to press the OK key and enter the new password. Press OK key a second time to save the new password.		

Edit Settings Menu page can also be accessed by pressing the left and up keys of the relay simultaneously and then the **OK** key; a password will be requested. Enter the password (the default factory password is "0000" for all password levels).

The relay resets to Protected Access Mode from both Full access and View access modes after 10 minutes of inactivity (no actions on the keypad).

To acknowledge setting changes, press the left and up keys on the faceplate simultaneously, followed by the OK key.

6. HANDLING AND INSTALLATION

6.1 GENERAL CONSIDERATIONS

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Do not interpret the off state of the LCD or Active LED as no current to the relay. Always check the relay measured current by powering the relay up from its USB port.
- Only appropriately trained persons who are familiar with and understand the contents of this manual and all other pertinent product documentation and who have received safety training to recognize and avoid hazards involved are authorized to work on and with this device. Installation, adjustment, repair and maintenance must be performed by qualified personnel.
- Before carrying out any work on the equipment, the user must be familiar with the contents of the safety section of this manual, and the ratings of the equipment.
- While handling, commissioning, or testing this equipment, apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- Before performing any commissioning, de-commissioning, or maintenance job on this product:
 - Open breakers and switches, and disconnect all power, including control power
 - Use a properly rated voltage sensing device to confirm that power is off.
 - Use lock out and tag out equipment to ensure the power remains off during the job.
 - Make sure that the grounding terminal is connected to the ground during and after the job (where applicable).
 - Allow the capacitors to discharge completely before touching any terminal.

Failure to follow these instructions will result in death or serious injury.

Note: The relay LCD and *Active* LED would be off under low current condition. Hence, these indicators must not be used on evaluating a no-current condition. To confirm that there is no current to the relay current inputs, customer must power the relay up from its USB port, using a PC or a battery bank.

DANGER

UNINTENDED EQUIPMENT OPERATION

The equipment documentation must be consulted before installing, commissioning, or servicing the equipment.

Failure to follow these instructions will result in death or serious injury.

It is strongly recommended to **set a password** on the ECOFIT 50/51 relay. This would minimize the possibility of setting changes or manual trip (from the relay), by an unauthorized person.

6.2 RELAY HANDLING

6.2.1 Receipt of relays

Protective relays, although generally of robust construction, require careful treatment prior to installation on site. Upon receipt, relays should be examined immediately to help to ensure no damage has been sustained in transit. If damage has been sustained during transit a claim should be made to the transport contractor and Schneider Electric should be promptly notified.

There are no setting adjustments within the module. Opening the case would damage the device and void the guarantee.

6.2.2 Unpacking

Care must be taken when unpacking and installing the relays so that none of the parts is damaged. Relays must only be handled by skilled personnel. The installation should be clean, dry and reasonably free from dust and excessive vibration. The site should be well lit to facilitate inspection. Relays that have been removed from their boxes should not be left in situations where they are exposed to dust or damp. This particularly applies to installations which are being carried out at the same time as construction work.

6.2.3 Storage

If relays are not to be installed immediately upon receipt they should be stored in a place free from dust and moisture in their original cartons. Where de-humidifier bags have been included in the packing they should be retained. The action of the de-humidifier crystals will be impaired if the bag has been exposed to ambient conditions and may be restored by gently heating the bag for about an hour, prior to replacing it in the carton.

Dust which collects on a carton may, on subsequent unpacking, find its way into the relay; in damp conditions the carton and packing may become impregnated with moisture and the dehumidifier will decrease its efficiency.

Storage temperature: -40°C to $+70^{\circ}\text{C}$.

Sustained exposure to high humidity during storage may cause damage to electronics and reduce the lifetime of the equipment. Therefore, once the products have been unpacked, we recommend that they are energized within the three following months.

Where electrical equipment is being installed, sufficient time should be allowed for acclimatization to the ambient temperature of the environment, before energization.

6.3 RELAY MOUNTING

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Do not open the secondary circuit of a live CT since the high voltage produced may be lethal to personnel and could damage insulation.
- The secondary of the line CT must be shorted before opening any connections to it.
- Before starting the retrofit job:
 - Make sure that all relay settings are configured and tested.
 - Carefully read the safety messages in the General Considerations section.

Failure to follow these instructions will result in death or serious injury.

The procedure provided in this section illustrate the process of replacing an electromechanical or solid state relay with an ECOFIT 50/51 relay. This process does not include any wiring change on the existing switchboard.

- Make sure to follow the safety notes above this procedure to de-energize the switchgear.
- If there is a test block on the switchgear, open the test terminals in order to isolate the relay from electrical sources.
- Open and remove the case cover.
- Withdraw the connection plug.
- Loosen the top and bottom latches.
- Withdraw the cradle and the old electromechanical relay.
- Verify that the brushes on the case and the new relay are clean from any rust or dust.
- Plug the new relay cradle into the case.
- Close the top and bottom latches.
- Inset the connection plug.
- Close the case cover and tighten all four screws.
- Test the relay operation by secondary injection into the test terminals.
- Close the test terminals and put the cover back after the tests are completed.

6.4 WIRING DIAGRAM

Figure 6-1 shows the wiring diagram of an ECOFIT 50/51 relay installed on a S1 cradle.

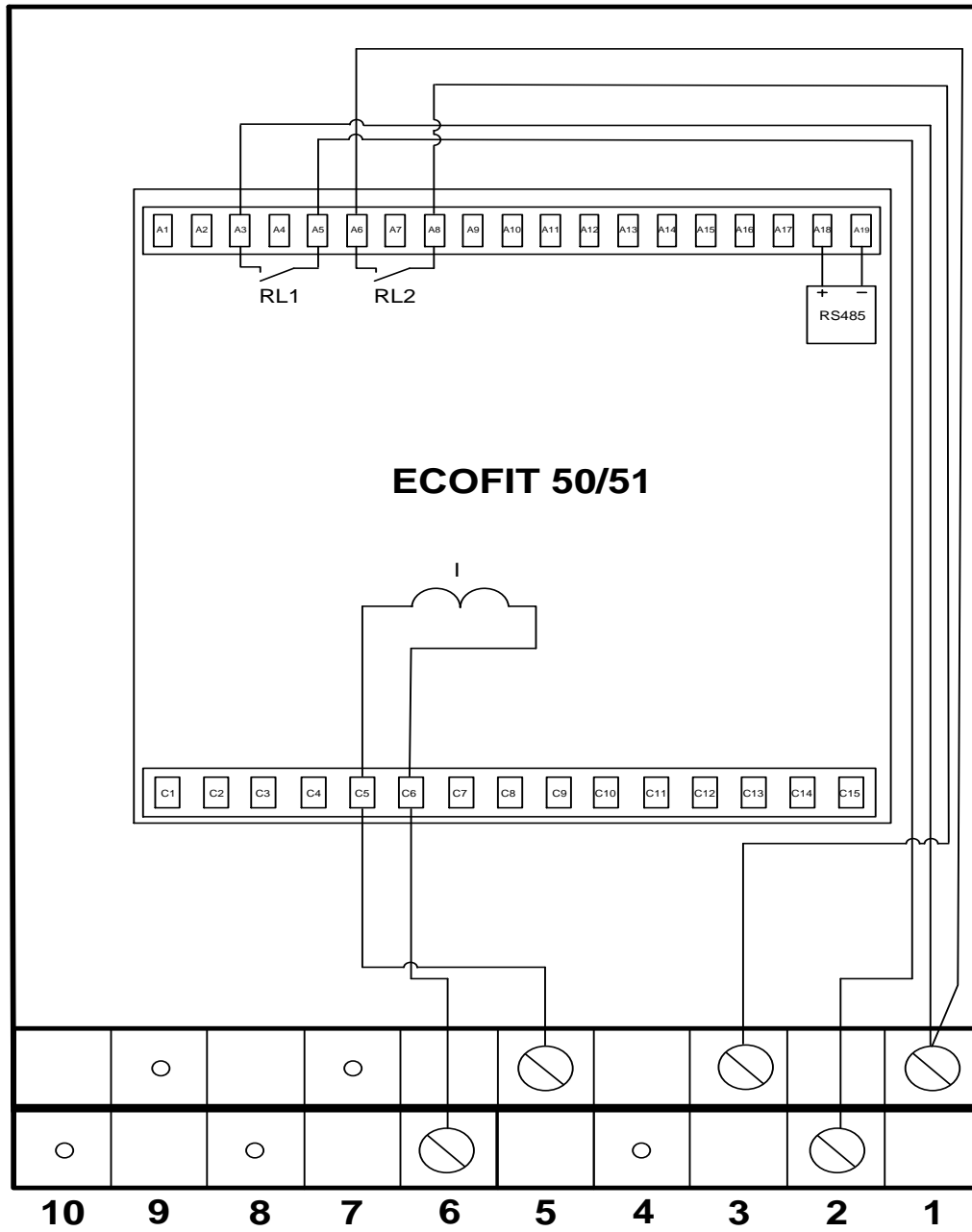


Figure 6-1: ECOFIT 50/51 wiring diagram

7. PRODUCT VALIDATION

7.1 GENERAL CONSIDERATIONS

This chapter explains the steps to test an ECOFIT 50/51 relay on a test bench. The relay is supposed to be installed on a test case. The case terminals would be wired to a test set. If customer would like to test the relay when it is installed on a switchgear, special care is required to help to ensure that the switchgear is de-energized, and remains isolated during the test.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Only appropriately trained persons who are familiar with and understand the contents of this manual and all other pertinent product documentation and who have received safety training to recognize and avoid hazards involved are authorized to work on and with this device. Installation, adjustment, repair and maintenance must be performed by qualified personnel.
- Before carrying out any work on the equipment, the user must be familiar with the contents of the safety section of this manual, and also the ratings of the equipment.
- While handling, commissioning, or testing this equipment, apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- After completing the tests make sure that the proper settings are loaded to the relay.
- Before performing any commissioning, testing, or maintenance job on this product:
 - Open breakers and switches, and disconnect all power, including control power
 - Use a properly rated voltage sensing device to confirm that power is off.
 - Use lock out and tag out equipment to ensure the power remains off during the job.
 - Make sure that the grounding terminal is connected to the ground during and after the job (where applicable).
 - Allow the capacitors to discharge completely before touching any terminal.

Failure to follow these instructions will result in death or serious injury.

For correct commissioning tests the following equipment is recommended:

Multifunctional single-phase dynamic current injection test set; The test set needs to have high voltage (up to 100Vrms) capacity on its current output for testing a self-powered relay. If the test set is configurable for different ratings, use the configuration with highest voltage limit on the current output. If the power capacity of the test set is low the testing may lead to the results which are not in line with the technical specification of the product. In some cases, the ability of power source can be improved by using an intermediate CT.

Multimeter with suitable ac current range. If not included in the multimeter, a continuity tester would be required.

Note that the accuracy of the test equipment needs to be considered when relay test results are compared to the tolerances provided in this manual.

7.2 VISUAL INSPECTION

Check the relay nameplate and verify that the ratings match customer requirement.

Carefully examine the relay to check that no physical damage has occurred during transportation.

Visually check the wires on the back of the assembly.

7.3 RELAY HARDWARE TESTS

7.3.1 Power supply test

Connect the relay to a PC using a Type A to Mini-B USB cable.

Confirm that the LCD light is on and the LCD is readable. The relay should show the measured current on the Welcome page.

Confirm that the *Active* LED is on and is not blinking. This confirms that the relay is healthy. If the *Active* LED is blinking or it is not turning on, the relay might experience some internal issue. Please contact SE customer care center for troubleshooting.

Note: Max current necessary to supply ECOFIT 50/51 from a USB port is 450mA. Standard USB controller on a PC offers 500mA; So it is not recommended to connect any additional devices to the same PC's USB controller. If the total power consumption from a PC's USB controller is greater than 500mA, ECOFIT 50/51 might reset permanently (ECOFIT 50/51 display and the green *Healthy* LED will be flashing).

7.3.2 LCD and LEDs test

Once the relay is powered up from the USB port, press the Clear button on the faceplate. Confirm that

The relay's LCD shows the measured current value, and its backlight is on.

All five red LEDs on the relay faceplate blink once, simultaneously.

7.3.3 Manual trip test

This test confirms that the relay contacts and the manual trip pushbuttons on the relay work fine.

- 1- Set the relay as follows:
 - Connect the ECOFIT 50/51 relay to a PC or a power bank using front USB port
 - Enable TIME element
SETTINGS/50/51 PROTECTIONS/TIME 1: Enabled
Note: TIME protection element is permanently assigned to relay output RL1.
 - Enable INST element.
SETTINGS/50/51 PROTECTION/INST 1: Enabled
 - Assign INST protection element to relay output RL2
SETTINGS/OUTPUT REALYS CONFIGURATION/INST: 10
 - Disabled TIMEBak element:
SETTINGS/50/51 PROTECTIONS/TIMEBak 0: Disabled
 - Enable MANUAL TRIP MODE:
GLOBAL SETTINGS/MANUAL TRIP MODE/Manual Trip Mode 1: Enabled
Note: Manual Trip Mode is indicated by special orange LED on the front panel. The LED is lit when the mode is enabled
- 2- Press the TIME key on the relay faceplate; Confirm that the TIME target is activated.
- 3- Press and hold the TIME key on the relay faceplate; Using a multimeter confirm that RL1 contact (Terminals 1 and 2) is closed.
- 4- Press the INST key on the relay faceplate; Confirm that the INST target is activated.
- 5- Press and hold the INST key on the relay faceplate; using a multimeter confirm that RL2 contact (Terminals 1 and 3) is closed.
- 6- Press the Clear button to clear the targets.
- 7- Disable *MANUAL TRIP MODE*:
GLOBAL SETTINGS/MANUAL TRIP MODE/Manual Trip Mode 0: Disabled

Note: If Manual Trip Mode remains on and there is no action on the keypad, the ECOFIT 50/51 disabled Manual Trip Mode after 10 minutes.

7.4 FUNCTIONAL TESTS

The functional tests confirm that the relay works within the acceptable ranges provided in this manual.

Before starting functional tests, two steps of preparation are required:

- 1- During functional tests the relay settings need to be revised. Please follow the instruction in Getting Started chapter on how to connect to the relay from a PC, or how to interact with relay from its HMI.
- 2- Connect a test set to the relay as shown in Figure 7-1. The test set needs to provide high power as explained in General Consideration section.

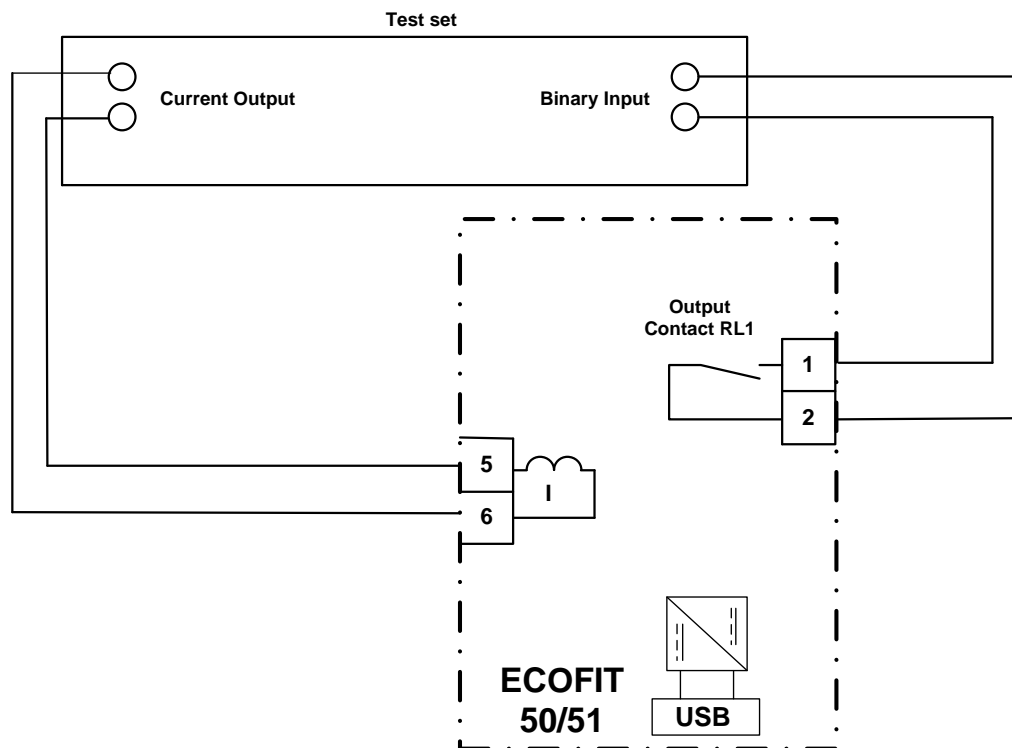


Figure 7-1 - Connection of the relay to a test set

7.4.1 Measurement

- 1- Set proper operating frequency
GLOBAL SETTINGS/LOCAL SETTINGS/Nominal Frequency 1: 60Hz.
- 2- Inject 5A (1A for 1A variant) to the relay current input.
- 3- Confirm that the relay LCD shows the measured current in the range of 4.9A to 5.1A (0.98A to 1.02A for 1A variant). Note that if CT ratio is changed from the default value of 1, the CT ratio needs to be multiplied to the provided range.

7.4.2 Pickup test

- 1- Set the relay as follows:
 - Operating frequency
GLOBAL SETTINGS/LOCAL SETTINGS/Nominal Frequency 1: 60Hz.
 - Enable TIME element
SETTINGS/50/51 PROTECTIONS/TIME 1: Enabled
 - TIME Pickup threshold
SETTINGS/50/51 PROTECTIONS/TIME Pickup: 5.00A (1.00A for 1A variant)
 - TIME Curve
SETTINGS/50/51 PROTECTIONS/TIME Curve 0: DT
 - TIME TD
SETTINGS/50/51 PROTECTIONS/TIME TD: 0.05 ms
 - TIME Rst Type
SETTINGS/50/51 PROTECTIONS/TIME Rst Type 0: Inst
 - Disable TIMEBak element
SETTINGS/50/51 PROTECTIONS/TIMEBak 0: Disabled
 - Disable INST element
SETTINGS/50/51 PROTECTIONS/INST 0: Disabled
 - Assign Start TIME signal to LED2
SETTINGS/LED CONFIGURATION/Start TIME

<i>Start</i>	<i>65432</i>
<i>TIME</i>	<i>00001</i>

- 2- Inject 4.5A (0.9A for 1A variant) and slowly increase the current until the LED2 turns on. RL1 contact closes at the same time. Record the pickup current value. Acceptable range for pickup value is 4.74A to 5.26A (0.94A to 1.06A for 1A variant).
- 3- Stop current injection.

7.4.3 Timing test – Without pre- fault

- 1- Set the relay as follows:
 - Operating frequency
GLOBAL SETTINGS/LOCAL SETTINGS/Nominal Frequency 1: 60Hz.
 - Enable TIME element
SETTINGS/50/51 PROTECTIONS/TIME 1: Enabled
 - TIME Pickup threshold
SETTINGS/50/51 PROTECTIONS/TIME Pickup: 5.00A (1.00A for 1A variant)
 - TIME Curve
SETTINGS/50/51 PROTECTIONS/TIME Curve 28: IEEE MI
 - TIME TD
SETTINGS/50/51 PROTECTIONS/TIME TD: 1.0 s
 - TIME Rst Type
SETTINGS/50/51 PROTECTIONS/TIME Rst Type 0: Inst
 - Disable TIMEBak element
SETTINGS/50/51 PROTECTIONS/TIMEBak 0: Disabled
 - Disable INST element
SETTINGS/50/51 PROTECTIONS/INST 0: Disabled

- 2- Inject 10.0A (2.0A for 1A variant) to the relay and measure the time elapsed from the start of injection until the relay output 1 (RL1) closes. The expected trip time is 3.803s ± time deviation which is 3.573s to 4.058s.
- 3- Stop current injection.

7.4.4 Timing test – With pre- fault

- 1- Set the relay as explained in the last section.
- 2- Inject 1A to the relay for 2 seconds.
- 3- Inject 10.0A (2.0A for 1A variant) to the relay and measure the time elapsed from the start of this injection until the relay output 1 (RL1) closes. The expected trip time is 3.803s \pm time deviation which is 3.573s to 4.033s.
- 4- Stop current injection.

7.4.5 Reset test

1. Connect output relay RL2 (contacts 1 and 3) to the second binary input of the test set.
2. Set the relay as follows:
 - Operating frequency
GLOBAL SETTINGS/LOCAL SETTINGS/Nominal Frequency 1: 60Hz.
 - Enable TIME element
SETTINGS/50/51 PROTECTIONS/TIME 1: Enabled
 - TIME Pickup threshold
SETTINGS/50/51 PROTECTIONS/TIME Pickup: 5.00A (1.00A for 1A variant)
 - TIME Curve
SETTINGS/50/51 PROTECTIONS/TIME Curve 28: IEEE VI
 - TIME TD
SETTINGS/50/51 PROTECTIONS/TIME TD: 1.0 s
 - TIME Rst Type
SETTINGS/50/51 PROTECTIONS/TIME Rst Type 1: DISC
 - Assign Start TIME signal to RL2
SETTINGS/OUTPUT REALYS CONFIGURATION/Start TIME
Start 21
TIME 10
 - Disable TIMEBak element
SETTINGS/50/51 PROTECTIONS/TIMEBak 0: Disabled
 - Disable INST element
SETTINGS/50/51 PROTECTIONS/INST 0: Disabled
3. Inject 10.0A (2.0A for 1A variant) to the relay and measure the time elapsed from the start of current flow to the relay output 1 (RL1) status change to close.
4. After relay tripped, reduce the current to 2.50A (0.50A for 1A variant) and measure elapsed time until relay output 2 (RL2) opens. Record measured time value. Expected reset time is 28.8s ($\pm 5\%$).
5. Stop current injection, and turn the test set off.

7.4.6 Relay setup after tests

The tests provided in this chapter would alter the settings of the relay. It's customer responsibility to load the proper settings into the relay, after tests are completed. It is recommended to use Easergy Studio for sending the setting file to the relay and making backup of the relay setting on the computer.

The tests also result in some records in the relay. These records could be erased by supervising the relay on Easergy Studio. After connecting to the relay, right-click on the device and select *Supervise Device...*, and select *Reset cell*. Below are the options:

- Clear records
- Clear events
- Reset Overcurrent Fault counter

8. OVERCURRENT CURVES

8.1 TRIP CURVES

Thirty-one IDMT curves are implemented in ECOFIT 50/51 as listed below. The curves can be set on TIME and TIMEBak protection elements.

- GE - IAC51, IAC53, IAC55, IAC66, IAC77
- Basler - I1, I2, V1, V2, S1, S2, L1, L2, E1, E2, M
- ABB - CO-2, CO-5, CO-7, CO-8, CO-9, CO-11
- SEL - U1, U2, U3, U4, U5
- IEEE - MI, VI, EI
- SE - Overload

The mathematical formulas and the constants for these curves are presented below:

Equation #	Time to Trip
1	$T = TD \times \left(\frac{k}{\left(\frac{G}{Gs}\right)^\alpha - P} + c \right) + B$
2	$T = TD \times \left(A + \frac{B}{\left(\frac{G}{Gs}\right) - C} + \frac{D}{\left(\left(\frac{G}{Gs}\right) - C\right)^2} + \frac{E}{\left(\left(\frac{G}{Gs}\right) - C\right)^3} \right)$

Where:

k, P, α , c, A, B, C, D, E = Constants

T = Time to trip in seconds

TD = Time dial

G = Measured current [A]

Gs = Current threshold setting [A]

Table 8-1: Time Dial range and constants for IDMT curves

Manufacture / Standard	Name	Eq #	Type of Curve	Time Dial range		k	P	α	c	B
				From	To					
Schneider	Overload	1	Motor Overload	0.5	20	30	1.1	1.7	0.6	0.028
GE	IAC 66	1	Long-Time Inverse	0.5	10	2.3955	1	0.3125	0.00002	0.028
Basler	S1	1	CO-2	0.5	10	0.2663	1	1.2969	0.03393	0.028
	L1	1	CO-5	0.5	10	5.6143	1	1	2.18592	0.028
	M	1	CO-7	0.5	10	0.3022	1	0.5	0.1284	0.028
	I1	1	CO-8	0.5	10	8.9341	1	2.0938	0.17966	0.028
	V1	1	CO-9	0.5	10	5.4678	1	2.0469	0.10814	0.028
	E1	1	CO-11	0.5	10	7.7624	1	2.0938	0.02758	0.028
	S2	1	IAC 55	0.5	10	0.0286	1	0.9844	0.0208	0.028
	L2	1	IAC 66	0.5	10	2.3955	1	0.3125	0.00002	0.028
	I2	1	IAC 51	0.5	10	0.2747	1	0.4375	0.1042	0.028
	V2	1	IAC 53	0.5	10	4.4309	1	1.9531	0.0991	0.028
E2	1	IAC 77	0.5	10	4.9883	1	2.0469	0.0129	0.028	
SEL	U1	1	Mod. Inverse	0.5	15	0.0104	1	0.02	0.0226	0
	U2	1	Inverse	0.5	15	5.95	1	2	0.18	0
	U3	1	Very Inverse	0.5	15	3.88	1	2	0.0963	0
	U4	1	Ext. Inverse	0.5	15	5.67	1	2	0.0352	0
	U5	1	Short-Time Inverse	0.5	15	0.00342	1	0.02	0.00262	0
Westinghouse / ABB	CO-2	1	Short-Time Inverse	0.5	11	0.1052	1	0.8	0.0262	0
	CO-5	1	Long-Time Inverse	0.5	11	4.842	1	1.1	1.967	0
	CO-7	1	Mod. Inverse	0.5	11	0.0094	1	0.02	0.0366	0
	CO-8	1	Inverse	0.5	11	5.848	1	2	0.1654	0
	CO-9	1	Very Inverse	0.5	11	4.12	1	2	0.0958	0
	CO-11	1	Ext. Inverse	0.5	11	5.57	1	2	0.028	0
IEEE	IEEE MI	1	Mod. Inverse	0.02	15	0.0515	1	0.02	0.114	0
	IEEE VI	1	Very Inverse	0.02	15	19.61	1	2	0.491	0
	IEEE EI	1	Ext. Inverse	0.02	15	28.2	1	2	0.1217	0
Manufacture / Standard	Name	Eq #	Type of Curve	From	To	A	B	C	D	E
GE	IAC 51	2	Inverse	0.5	10	0.2078	0.863	0.8	-0.418	0.1947
	IAC 53	2	Very Inverse	0.5	10	0.09	0.7955	0.1	-1.2885	7.9586
	IAC 55	2	Short-Time Inverse	0.5	10	0.0428	0.0609	0.62	-0.001	0.0221
	IAC 77	2	Ext. Inverse	0.5	10	0.004	0.6379	0.62	1.7872	0.2461

8.2 RESET CURVES

For each overcurrent curve, a reset curve is provided. These curves can be set on TIME and TIMEBak protection elements.

- GE - IAC51, IAC53, IAC55, IAC66, IAC77
- Basler - I1, I2, V1, V2, S1, S2, L1, L2, E1, E2, M
- ABB - CO-2, CO-5, CO-7, CO-8, CO-9, CO-11
- SEL - U1, U2, U3, U4, U5
- IEEE - MI, VI, EI
- SE - Overload

The mathematical formulas and the constants for these curves are presented below:

Time to Reset

$$T_{reset} = TD \times \left(\frac{tr}{1 - \left(\frac{G}{Gs}\right)^z} \right)$$

Where:

tr, Z = Constants

T_{reset} = Time to Reset in seconds

TD = Time dial

G = Measured current [A]

G_s = Current threshold setting [A]

Table 8-2 Constants for reset curves

Manufacture / Standard	Name	Type of Curve	tr	z
Schneider	Overload	Motor Overload	7.8001	2
GE	IAC 66	Long-Time Inverse	7.8001	2
Basler	S1	CO-2	0.5000	2
	L1	CO-5	15.7500	2
	M	CO-7	1.7500	2
	I1	CO-8	9.0000	2
	V1	CO-9	5.5000	2
	E1	CO-11	7.7500	2
	S2	IAC 55	0.0940	2
	L2	IAC 66	7.8001	2
	I2	IAC 51	0.8868	2
	V2	IAC 53	5.8231	2
E2	IAC 77	4.7742	2	
SEL	U1	Mod. Inverse	1.0800	2
	U2	Inverse	5.9500	2
	U3	Very Inverse	3.8800	2
	U4	Ext. Inverse	5.6700	2
	U5	Short-Time Inverse	0.3230	2
Westinghouse / ABB	CO-2	Short-Time Inverse	10.5000	2
	CO-5	Long-Time Inverse	4.8500	2
	CO-7	Mod. Inverse	0.9400	2
	CO-8	Inverse	5.8500	2
	CO-9	Very Inverse	4.1200	2
	CO-11	Ext. Inverse	5.5570	2
IEEE	IEEE MI	Mod. Inverse	4.8500	2
	IEEE VI	Very Inverse	21.6000	2
	IEEE EI	Ext. Inverse	29.1000	2
GE	IAC 51	Inverse	0.9900	2
	IAC 53	Very Inverse	4.6780	2
	IAC 55	Short-time Inverse	0.2220	2
	IAC 77	Ext. Inverse	6.008	2

8.3 GRAPHICAL ILLUSTRATION

Graphical illustrations of the IDMT trip curves are provided by 31 figures of this chapter.

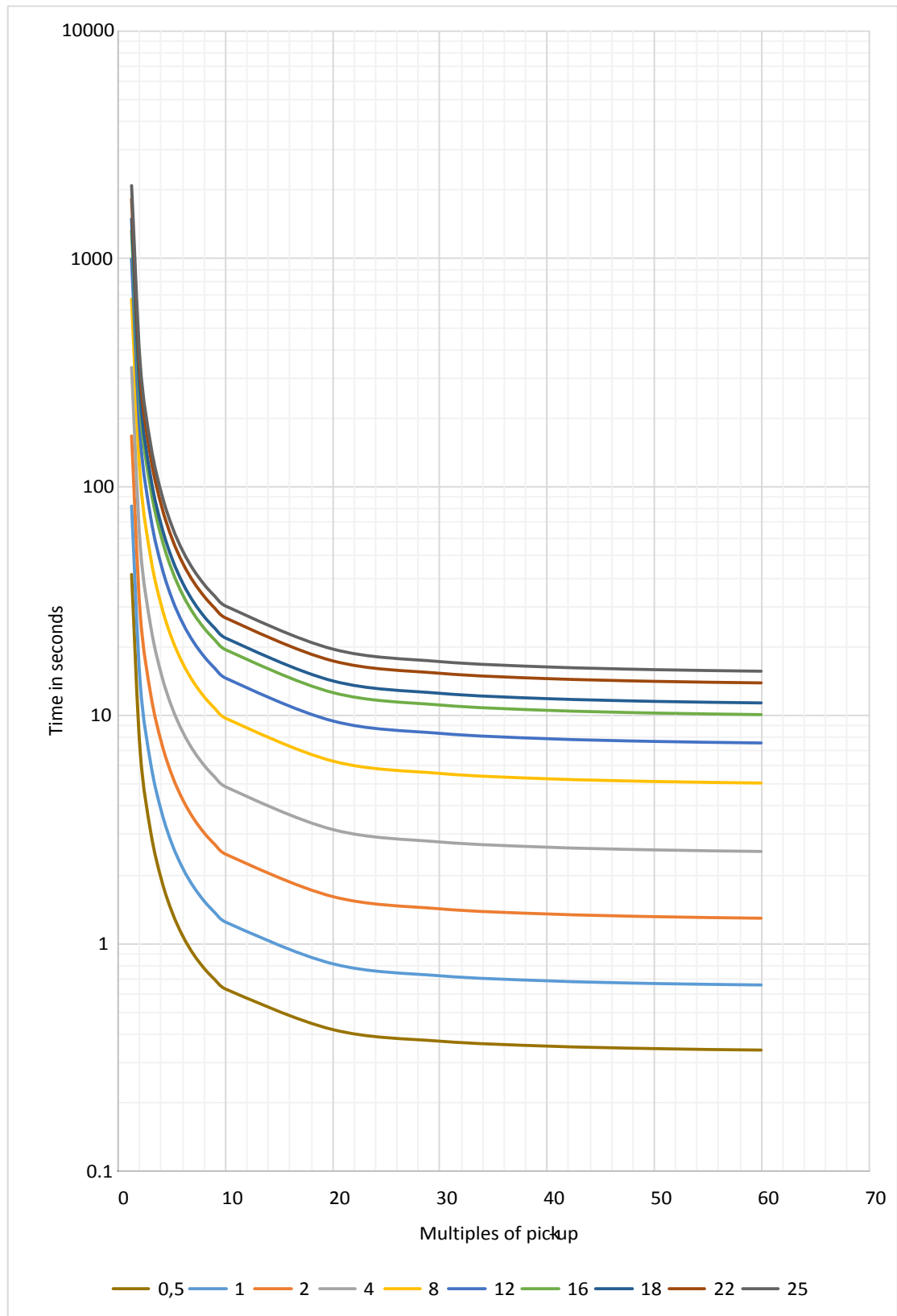


Figure 8-1: Overload (Manufacturer: Schneider)

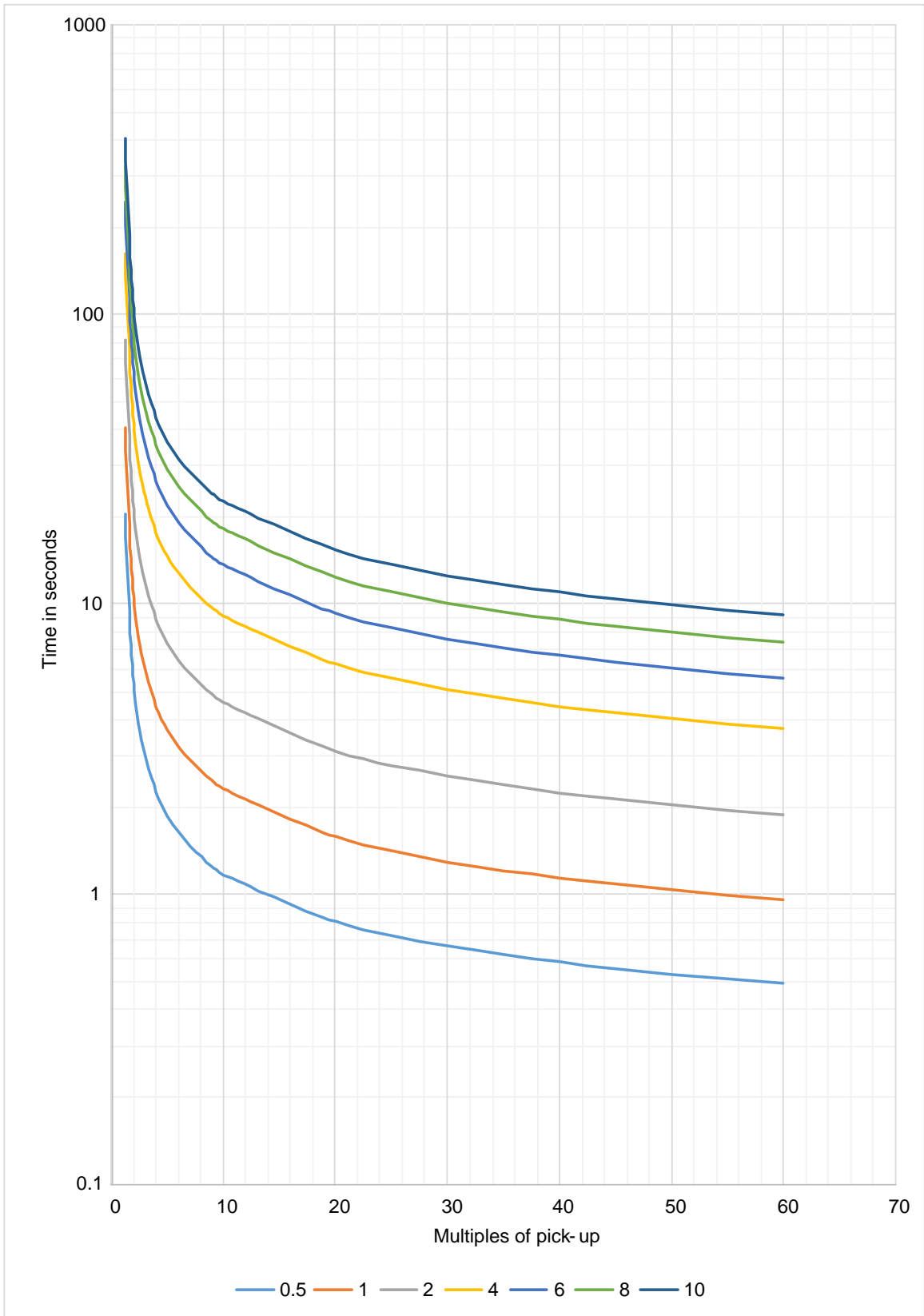


Figure 8-2: IAC66 Curve (Manufacturer: GE)

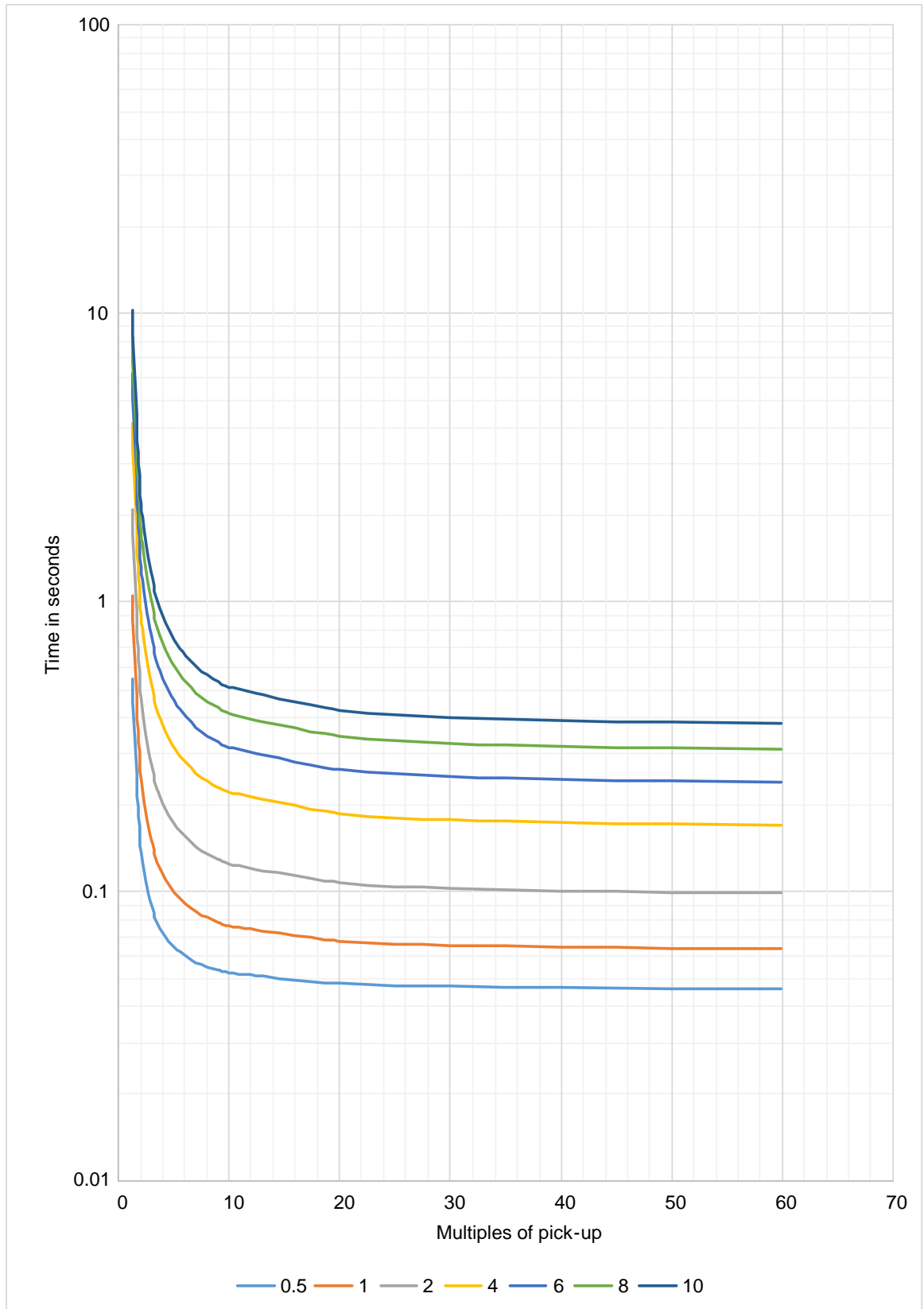


Figure 8-3: S1 Curve (Manufacturer: Basler)

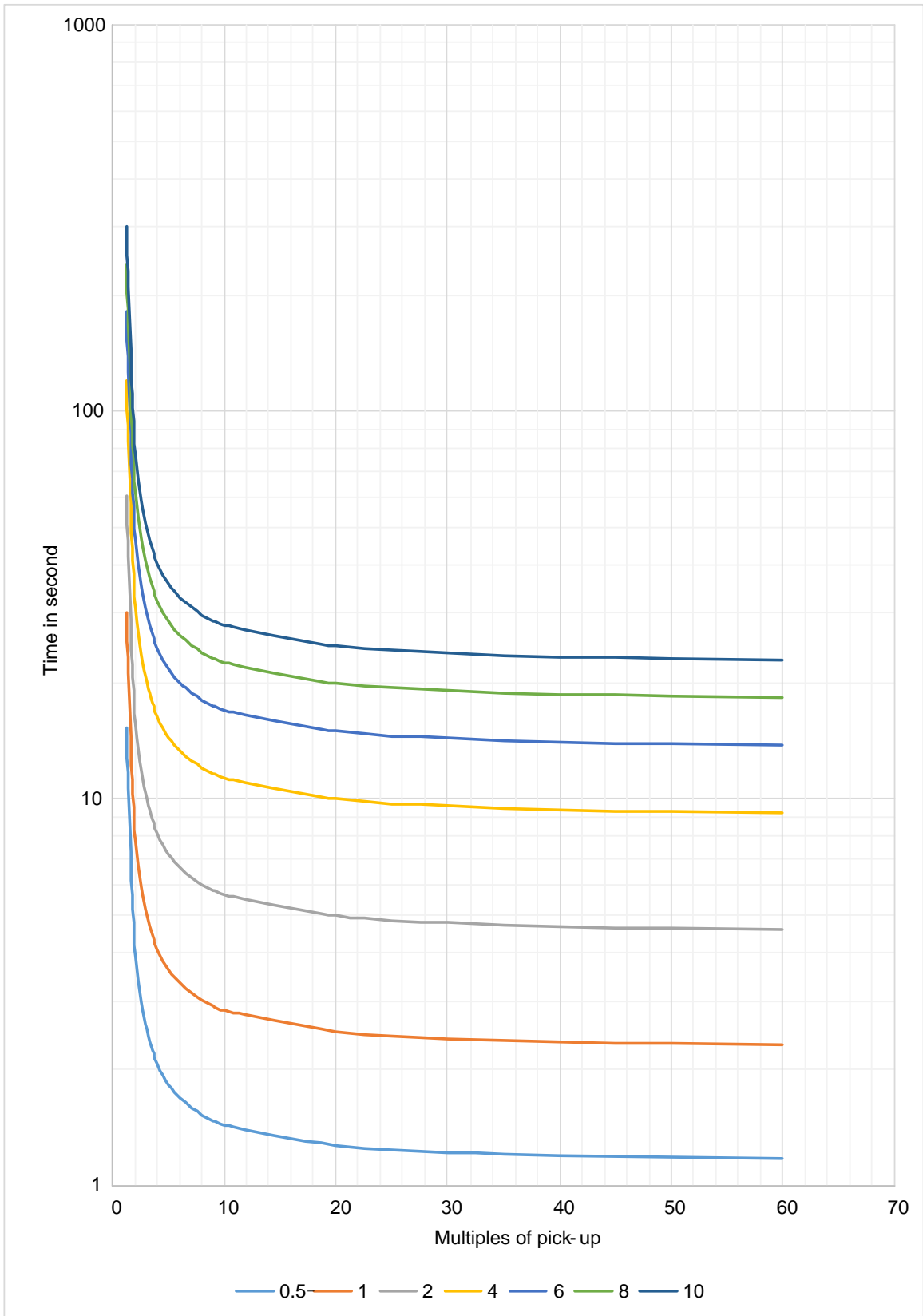


Figure 8-4: L1 Curve (Manufacturer: Basler)

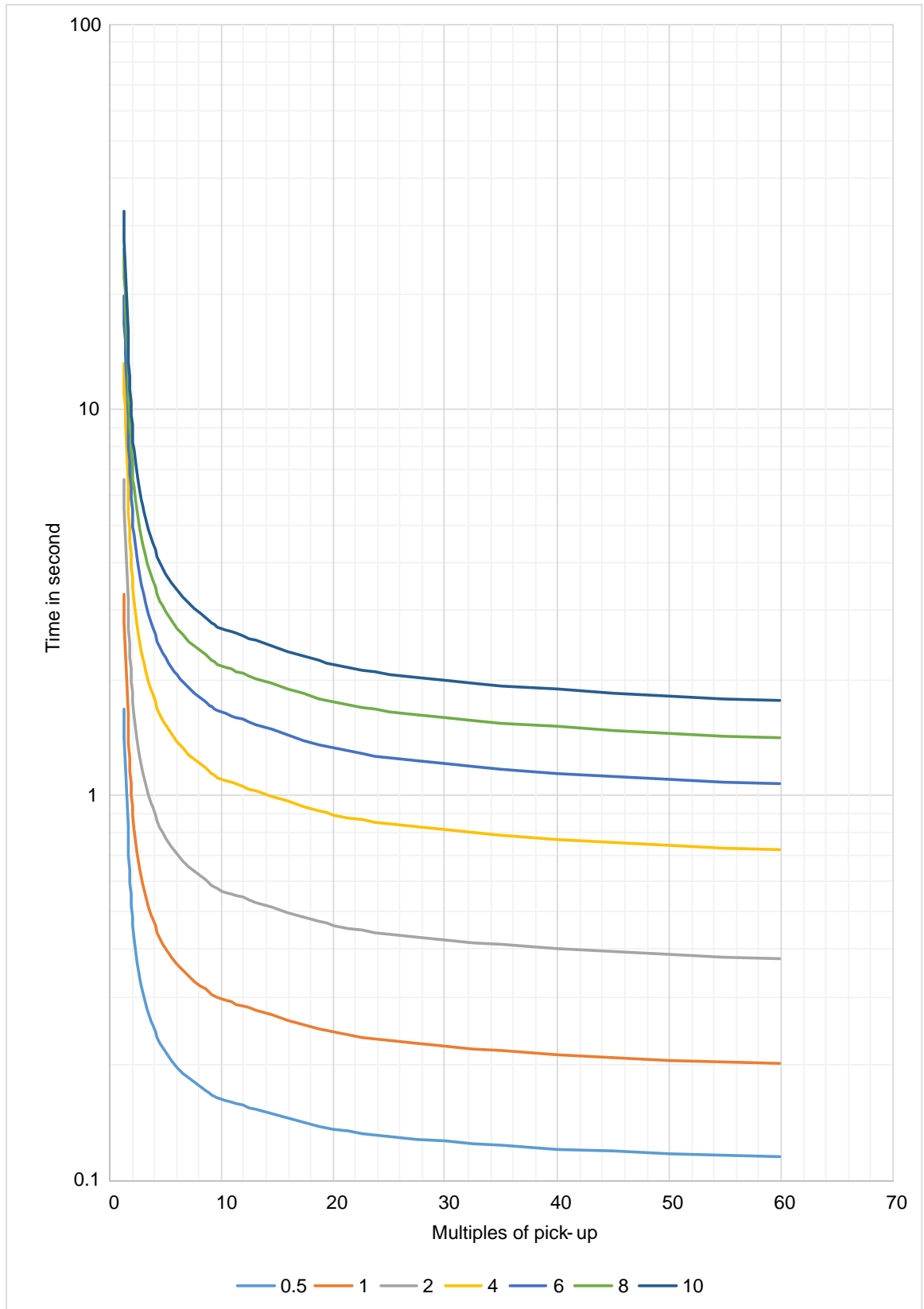


Figure 8-5: M Curve (Manufacturer: Basler)

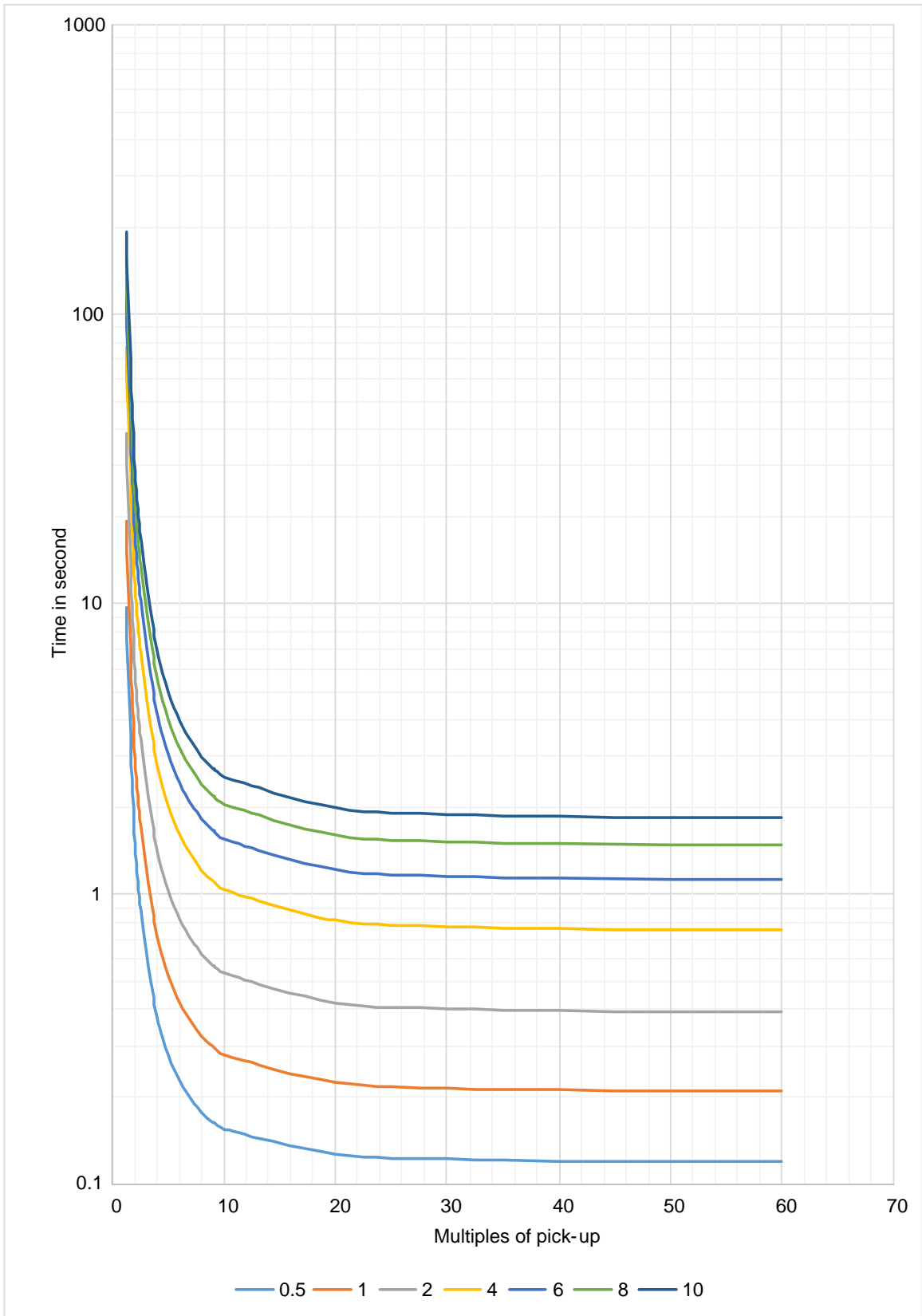


Figure 8-6: I1 Curve (Manufacturer: Basler)

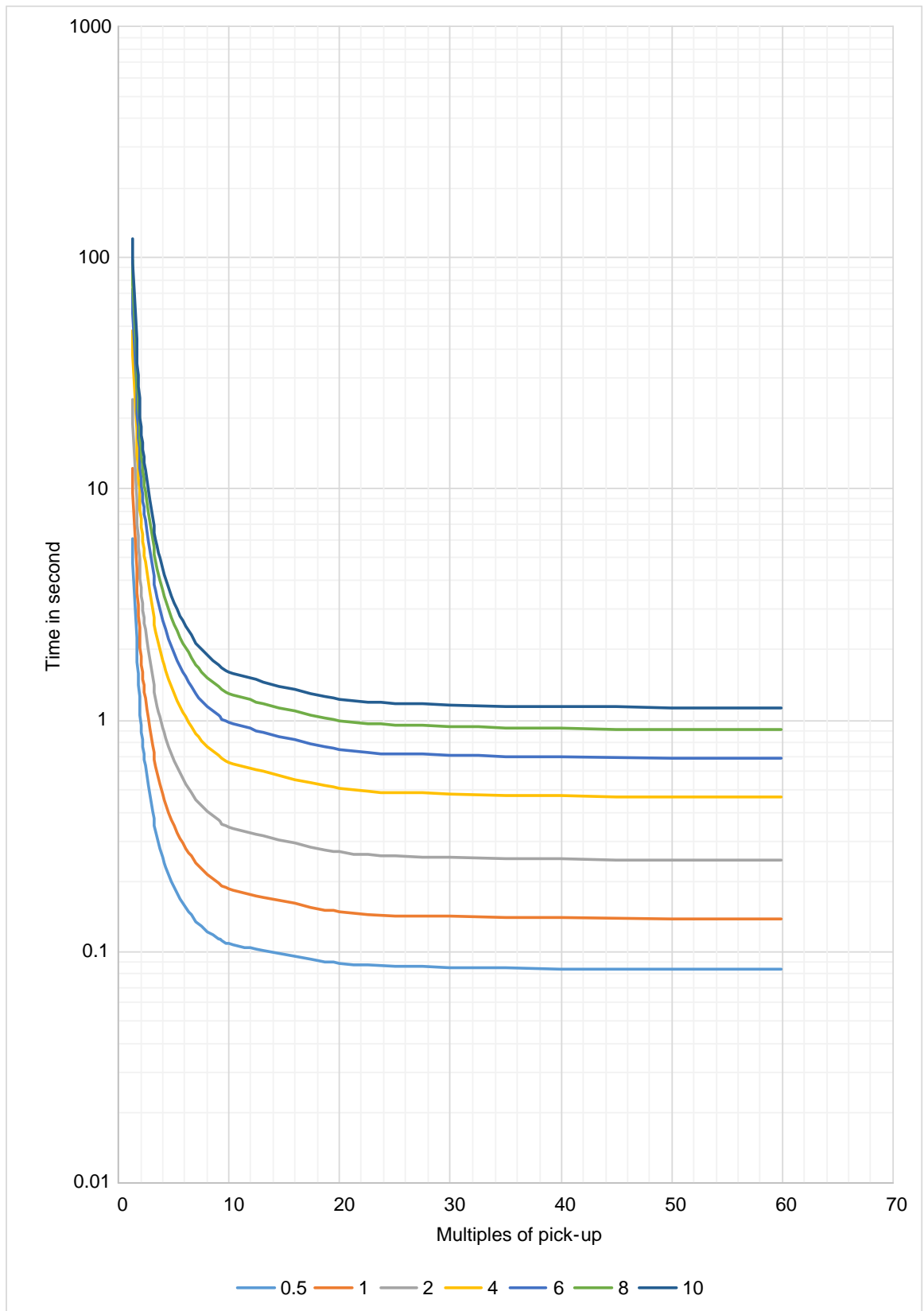


Figure 8-7: V1 Curve (Manufacturer: Basler)

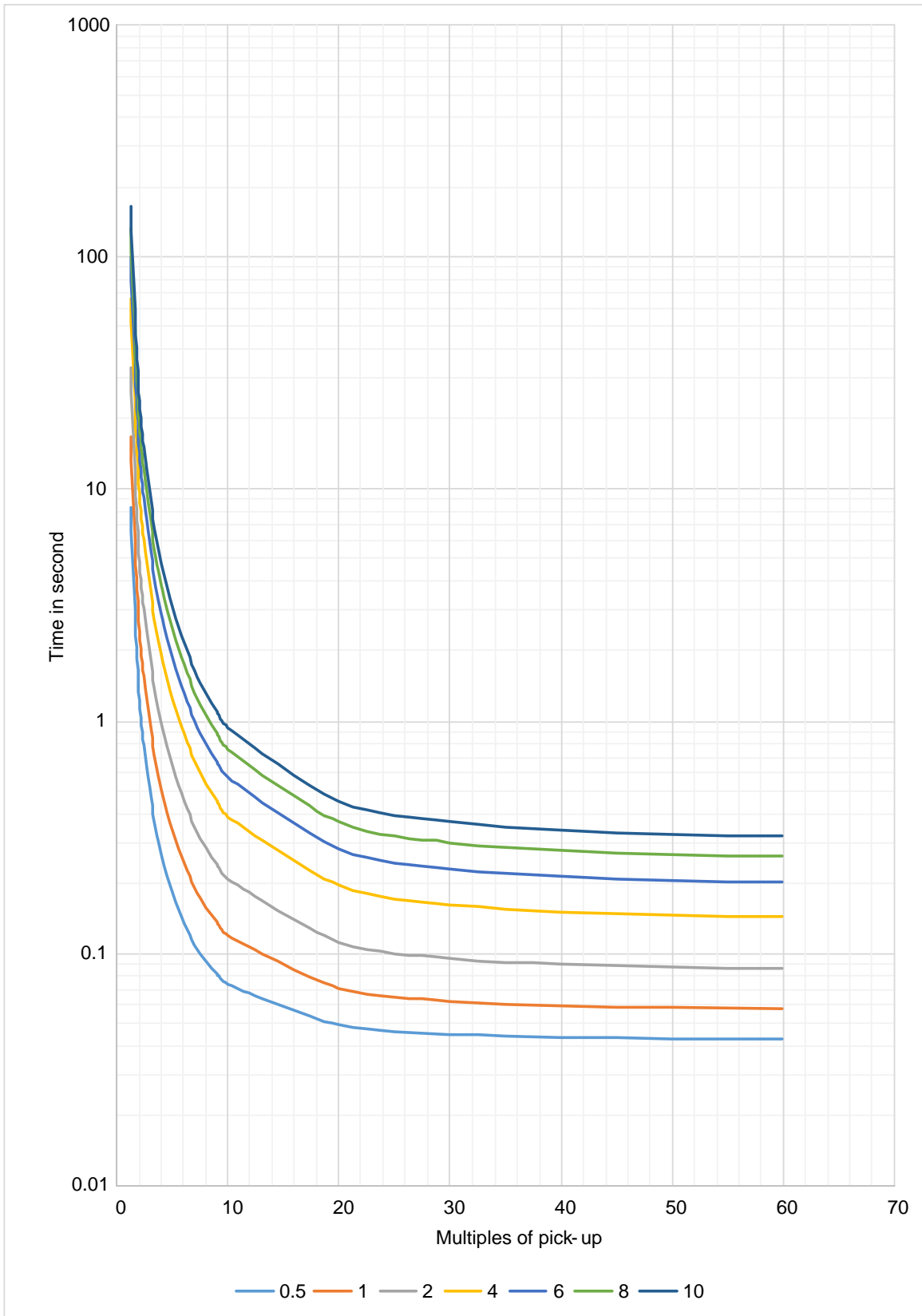


Figure 8-8: E1 Curve (Manufacturer: Basler)

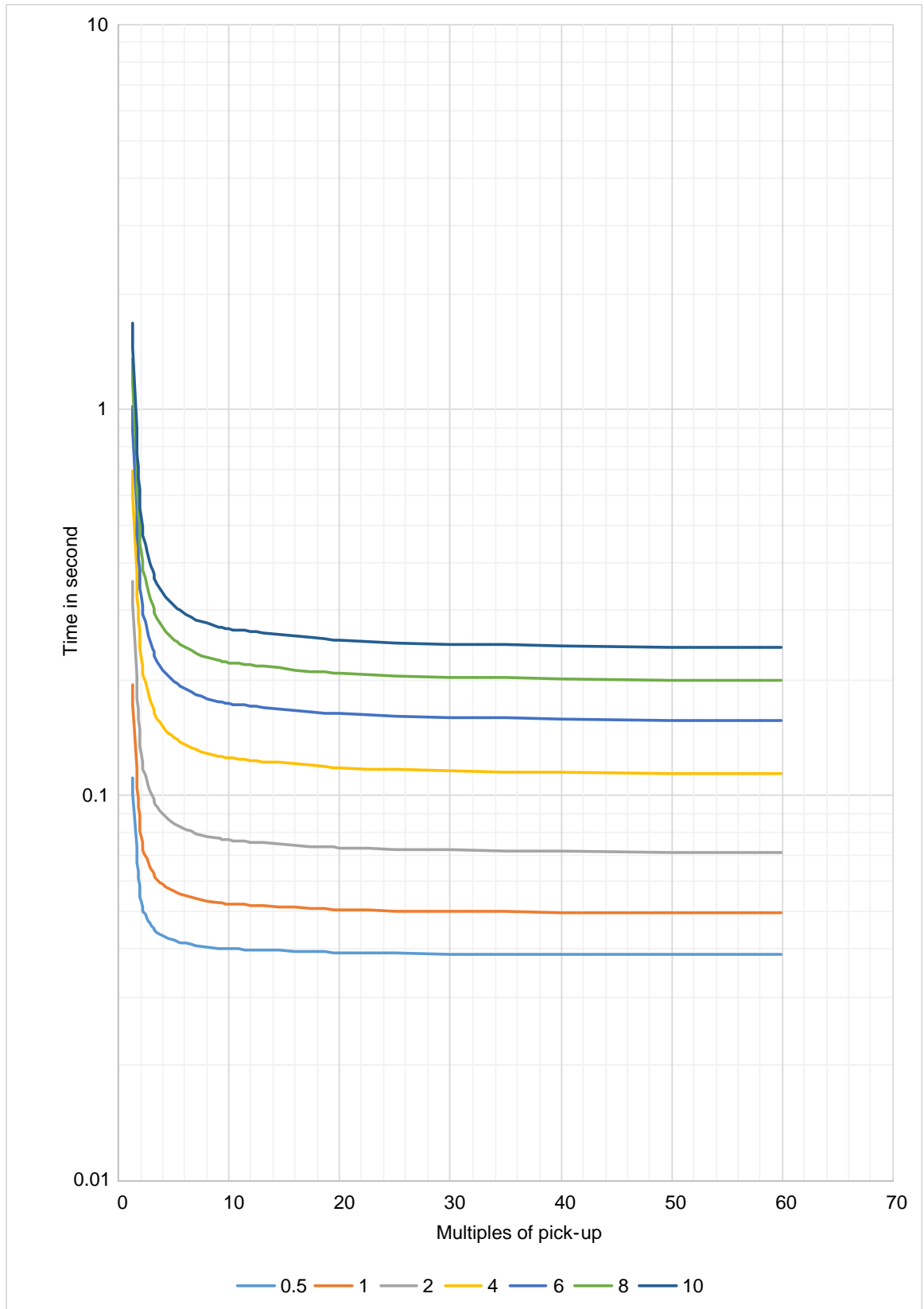


Figure 8-9: S2 Curve (Manufacturer: Basler)

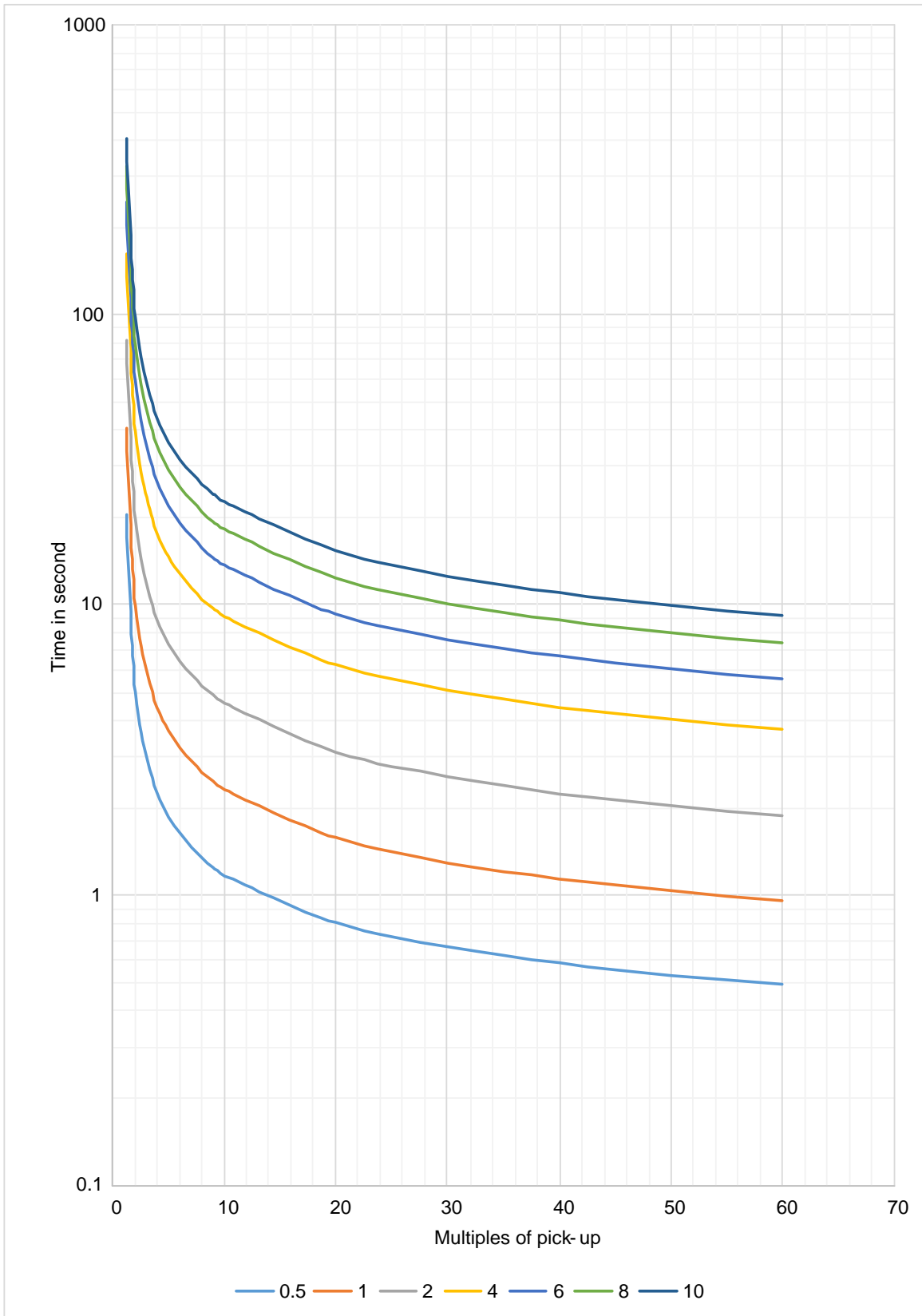


Figure 8-10: L2 Curve (Manufacturer: Basler)

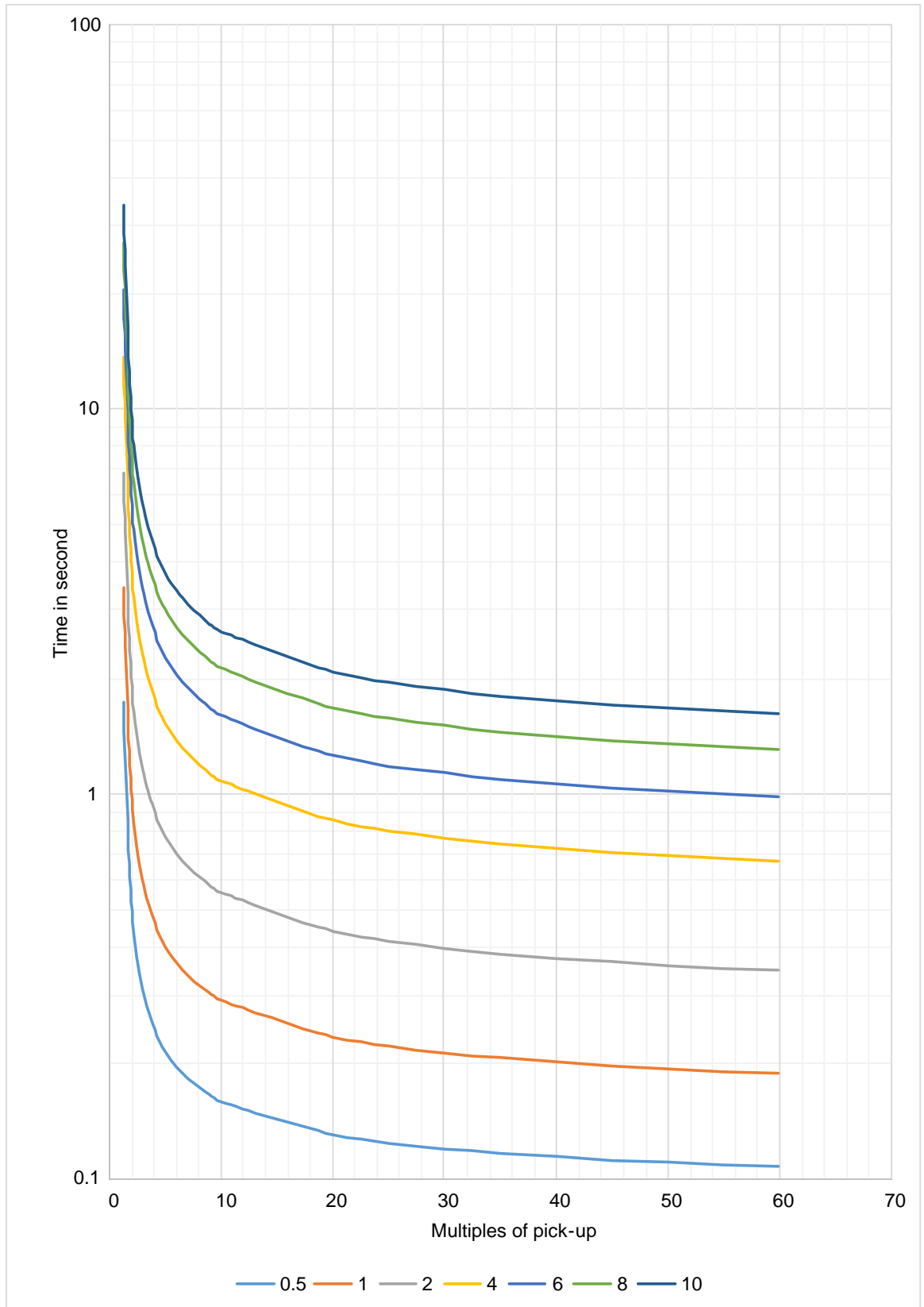


Figure 8-11: I2 Curve (Manufacturer: Basler)

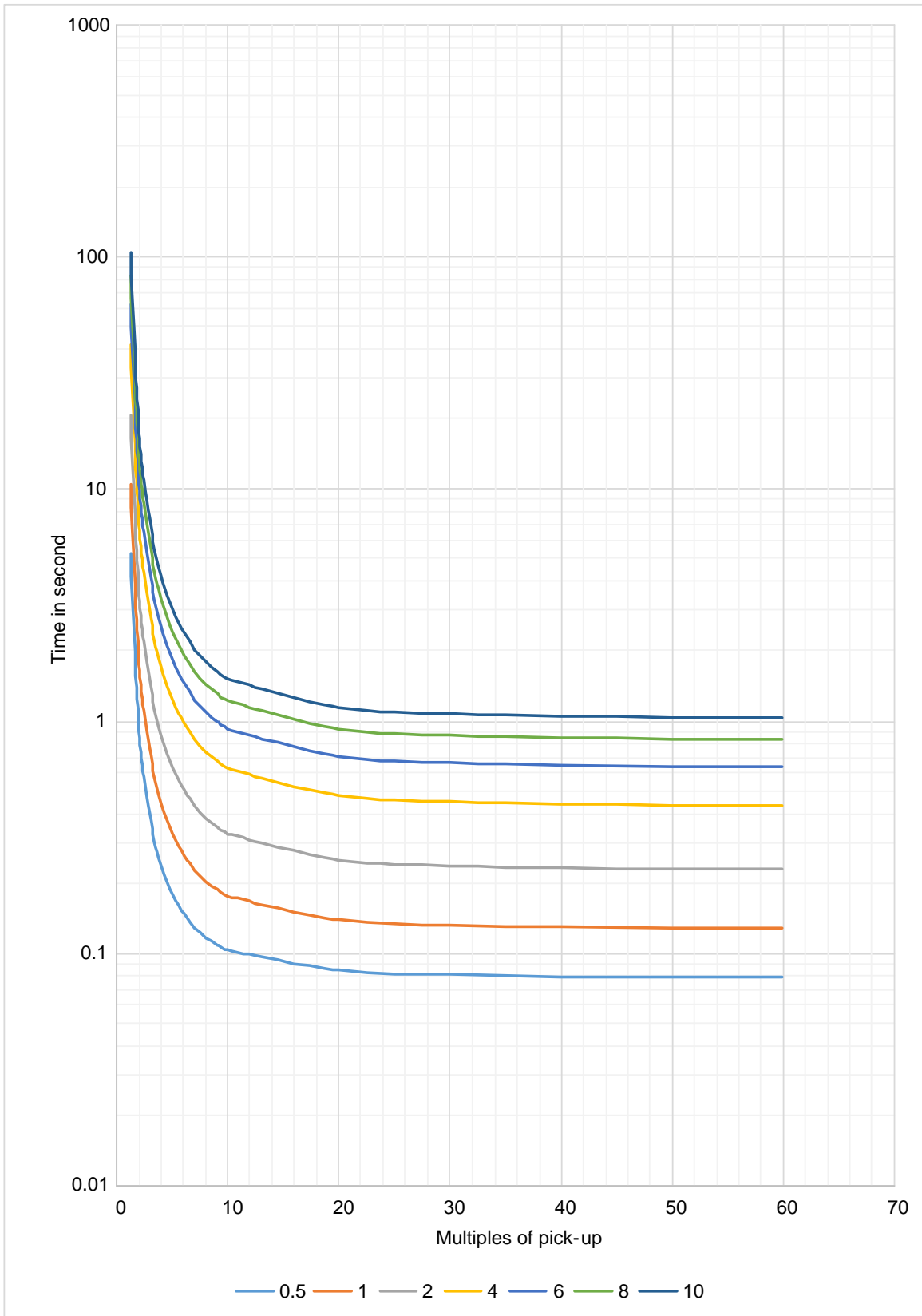


Figure 8-12: V2 Curve (Manufacturer: Basler)

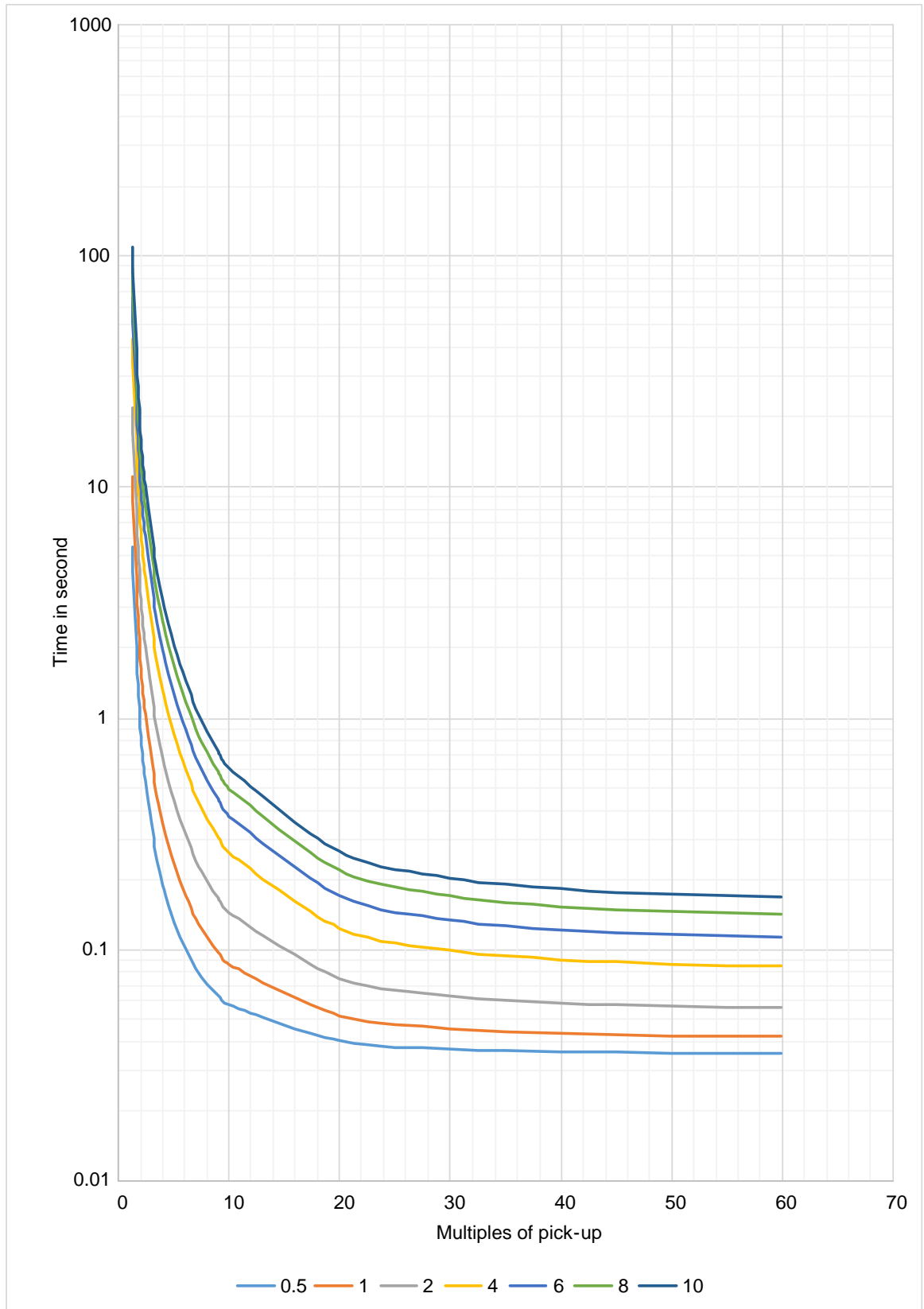


Figure 8-13: E2 Curve (Manufacturer: Basler)

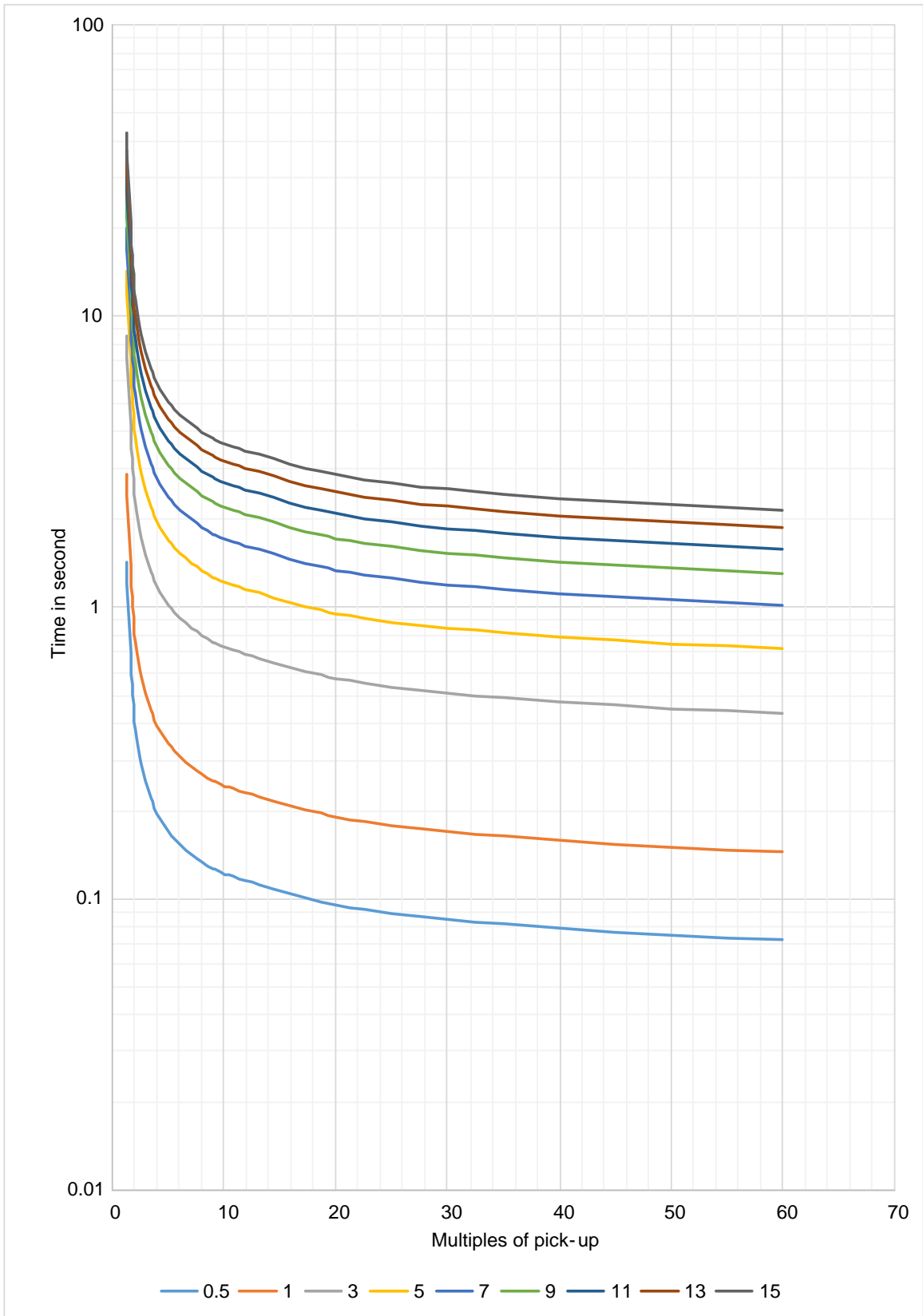


Figure 8-14: U1 Curve (Manufacturer: SEL)

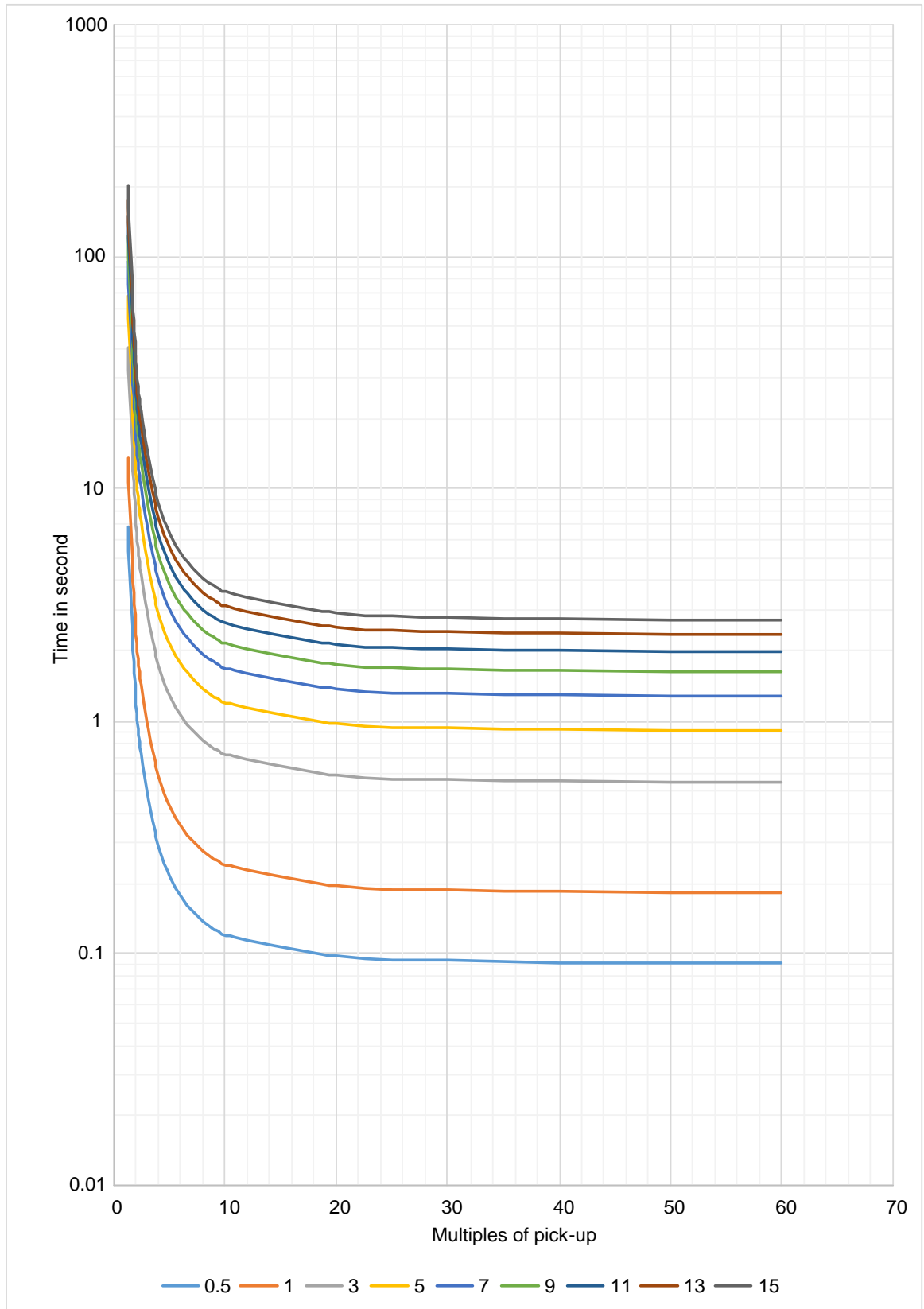


Figure 8-15: U2 Curve (Manufacturer: SEL)

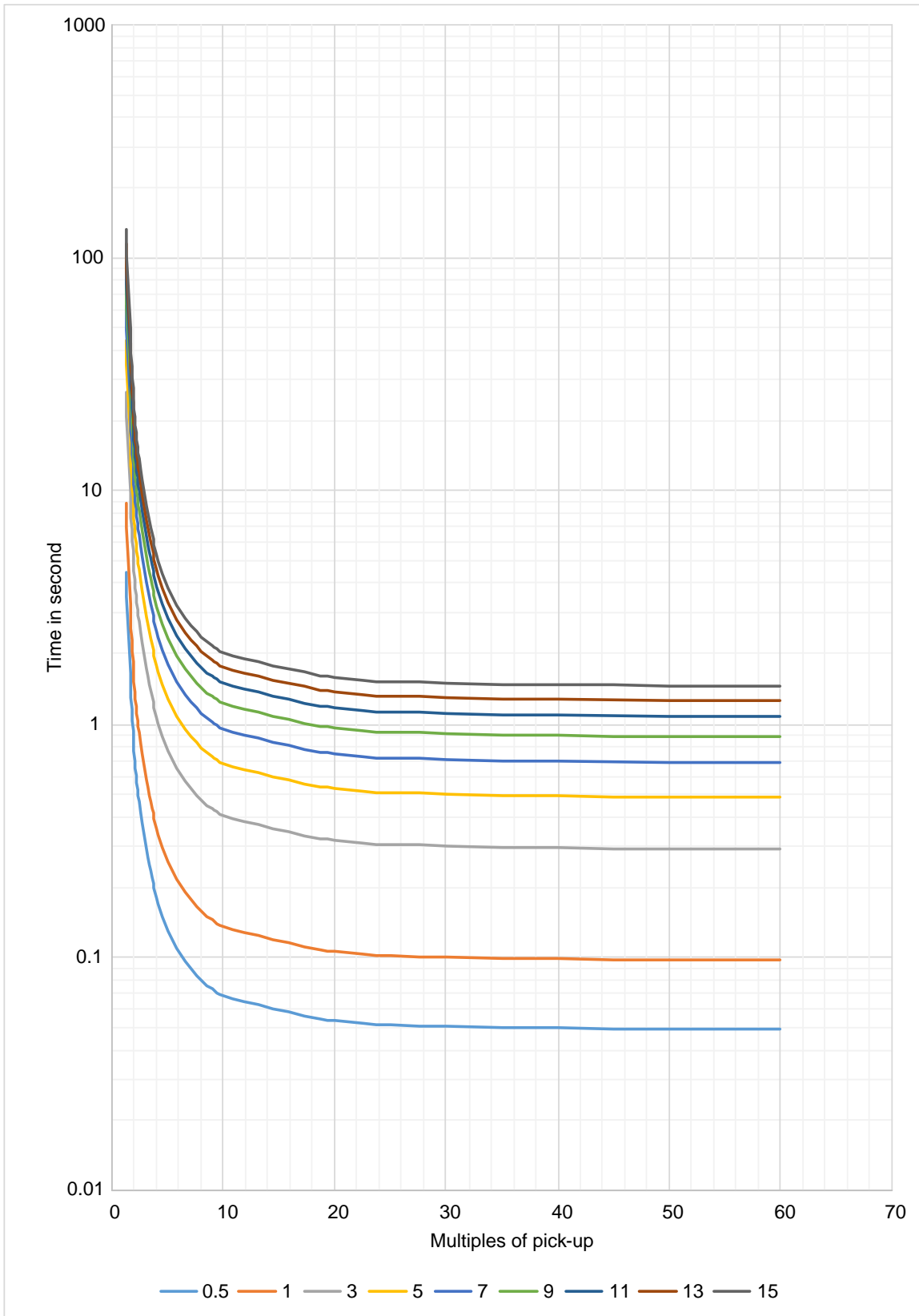


Figure 8-16: U3 Curve (Manufacturer: SEL)

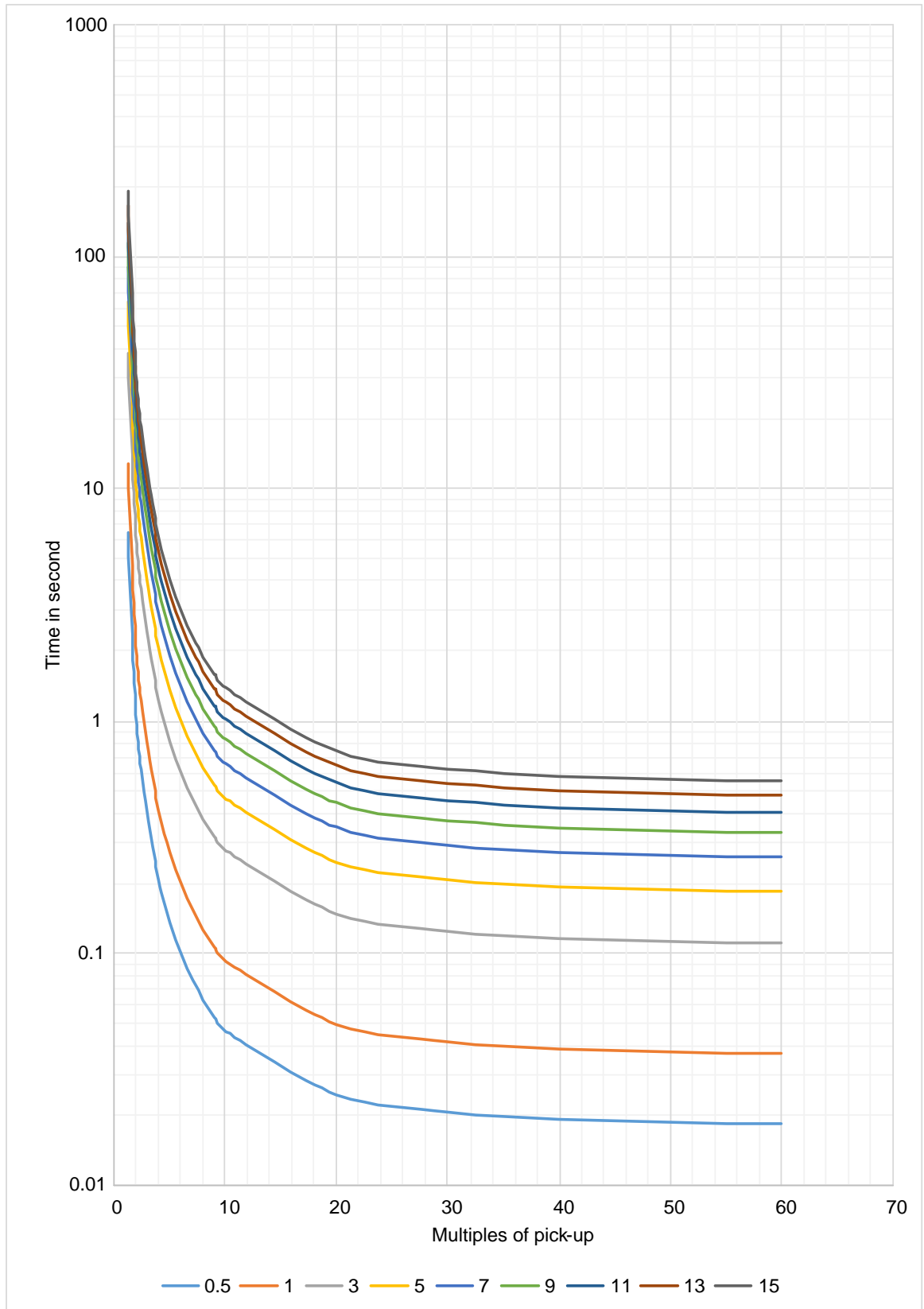


Figure 8-17: U4 Curve (Manufacturer: SEL)

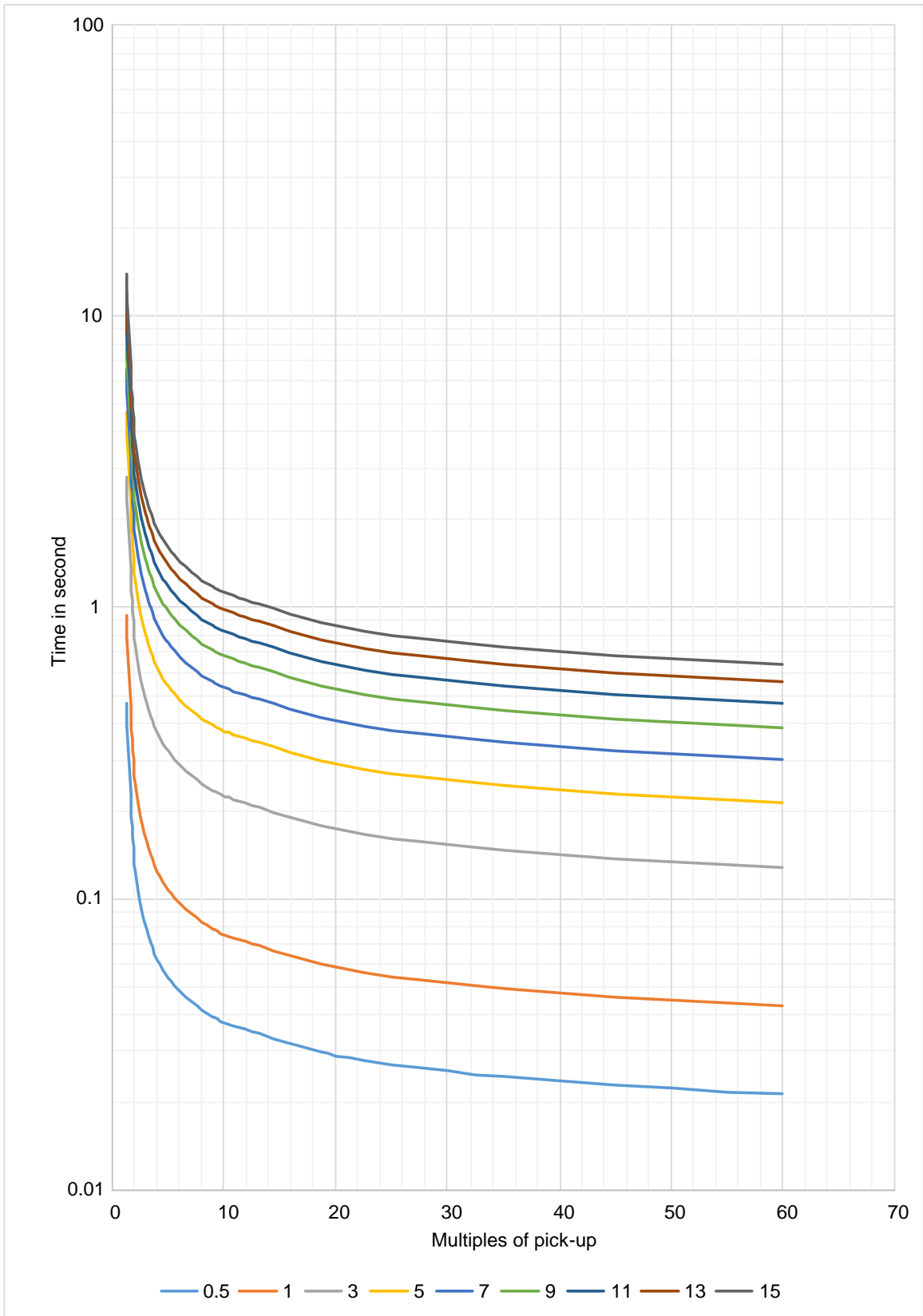


Figure 8-18: U5 Curve (Manufacturer: SEL)

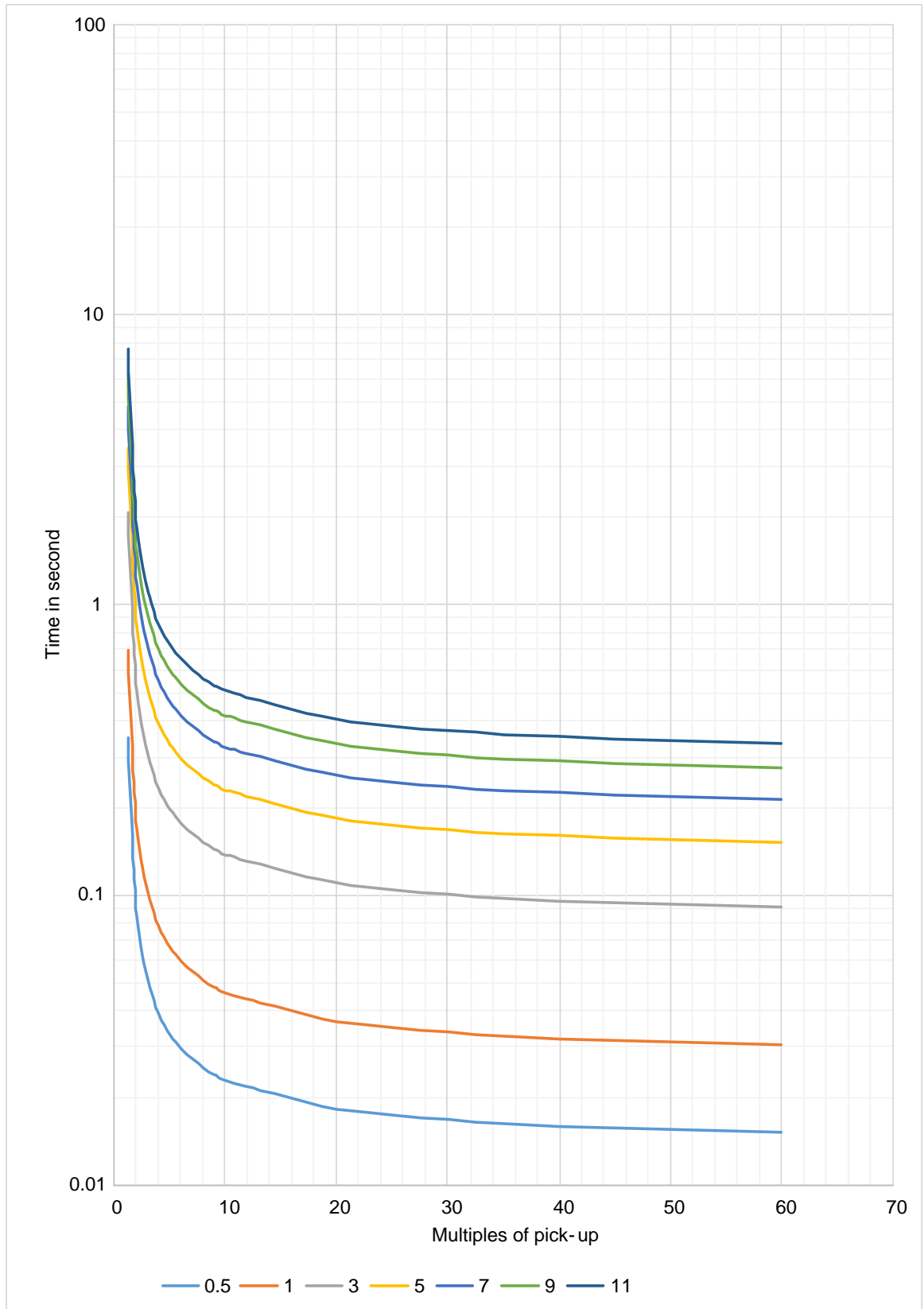


Figure 8-19: CO-2 Curve (Manufacturer: Westinghouse/ABB)

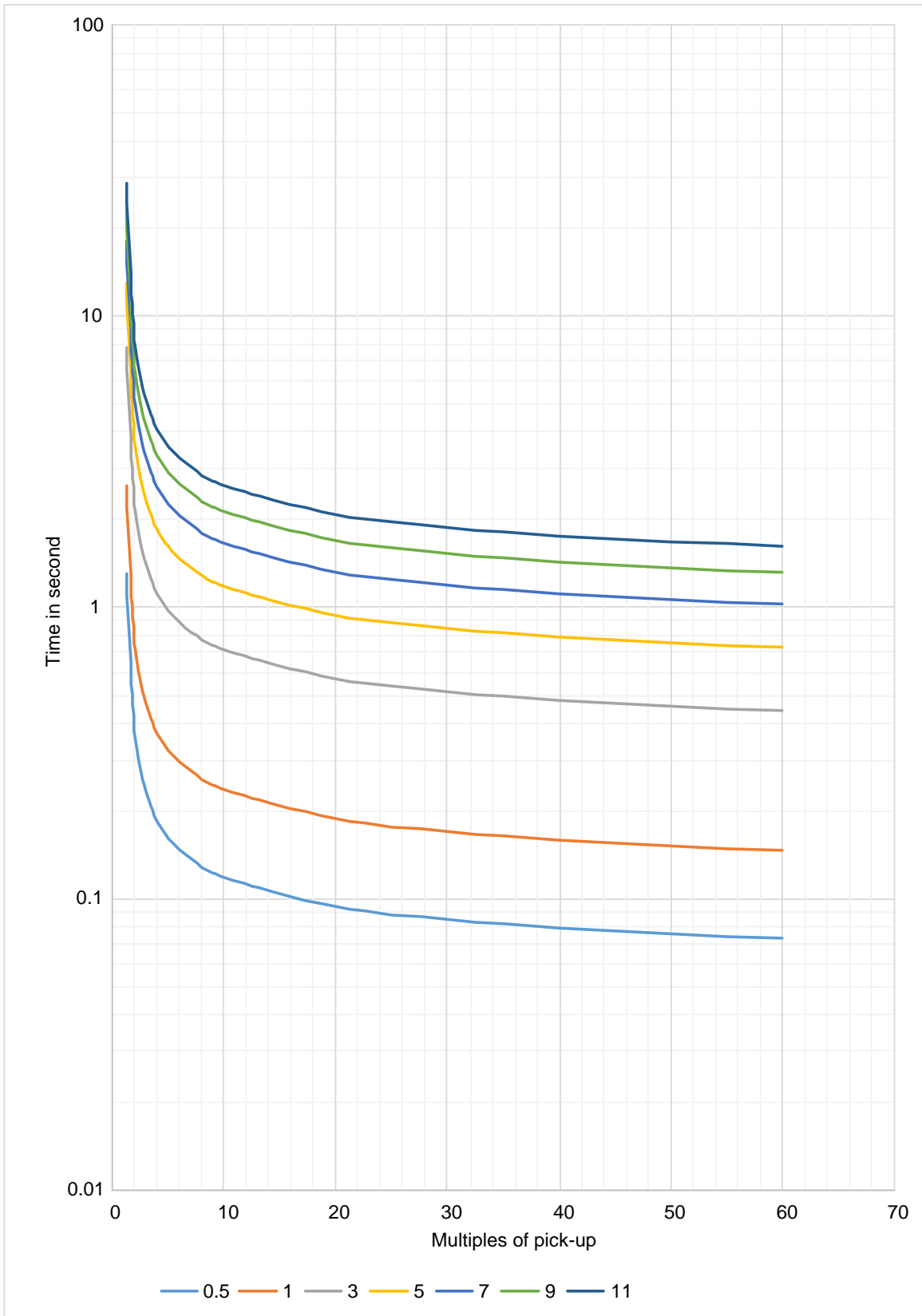


Figure 8-20: CO-5 Curve (Manufacturer: Westinghouse/ABB)

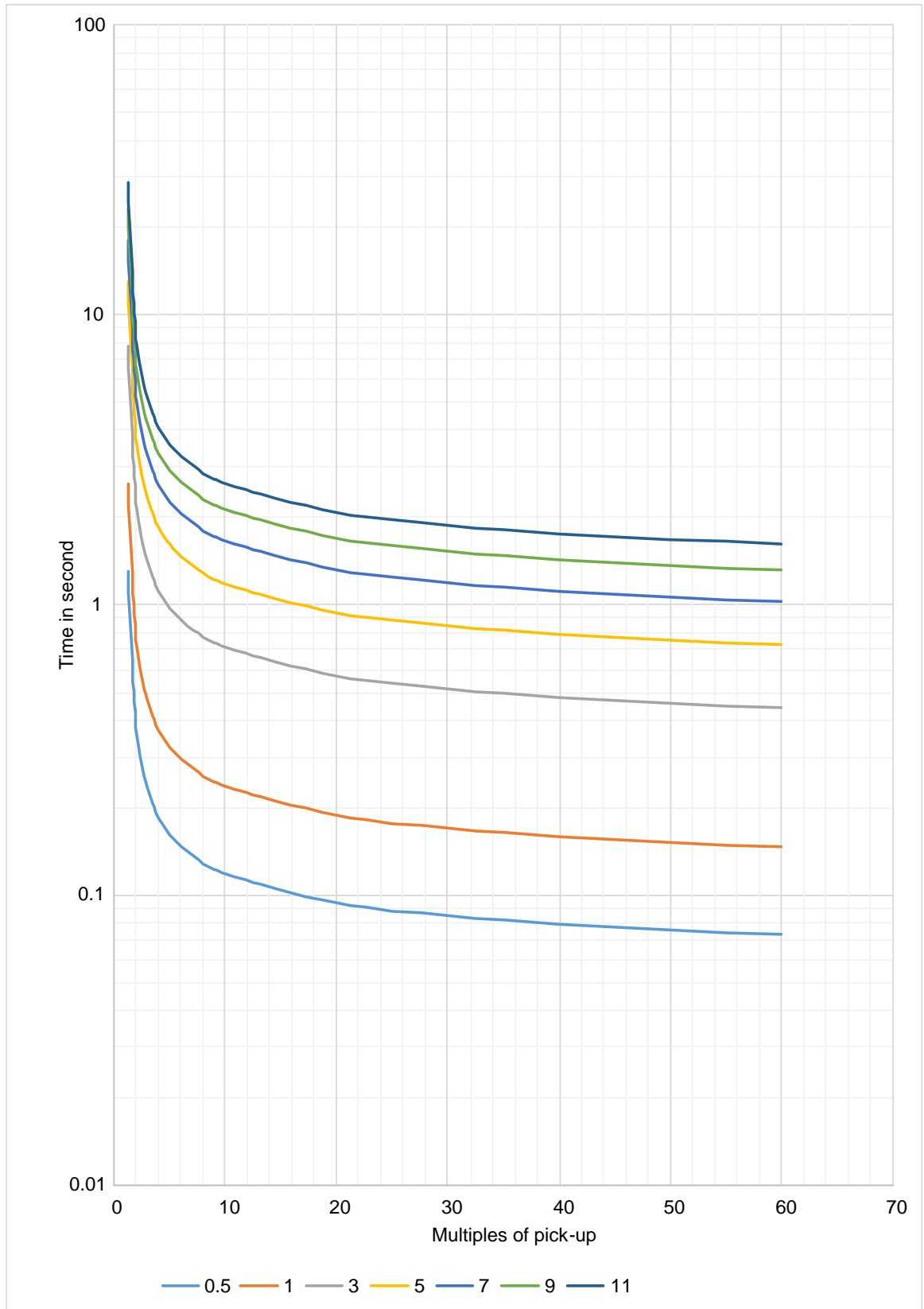


Figure 8-21: CO-7 Curve (Manufacturer Westinghouse/ABB)

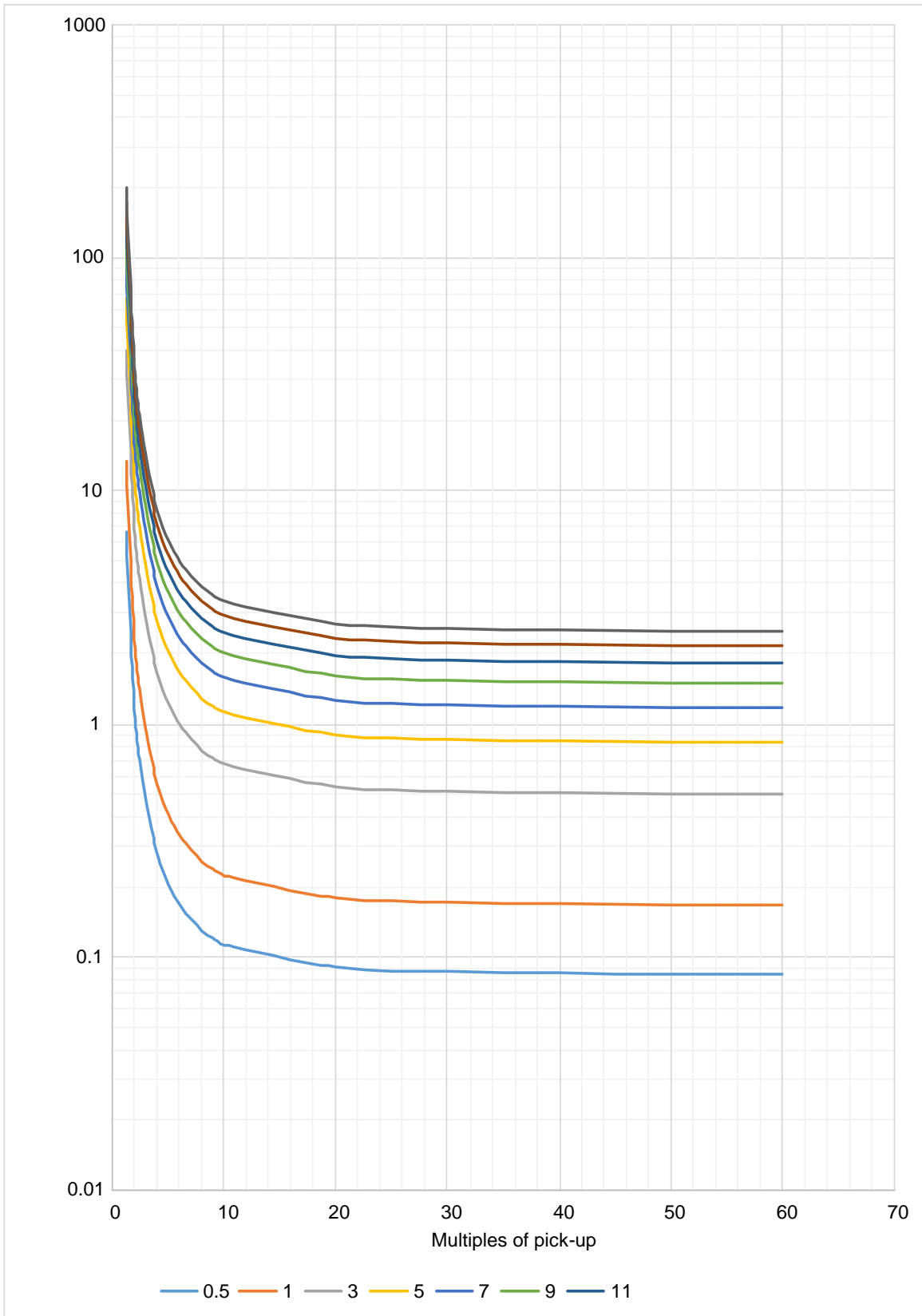


Figure 8-22: CO-8 Curve (Manufacturer: Westinghouse/ABB)

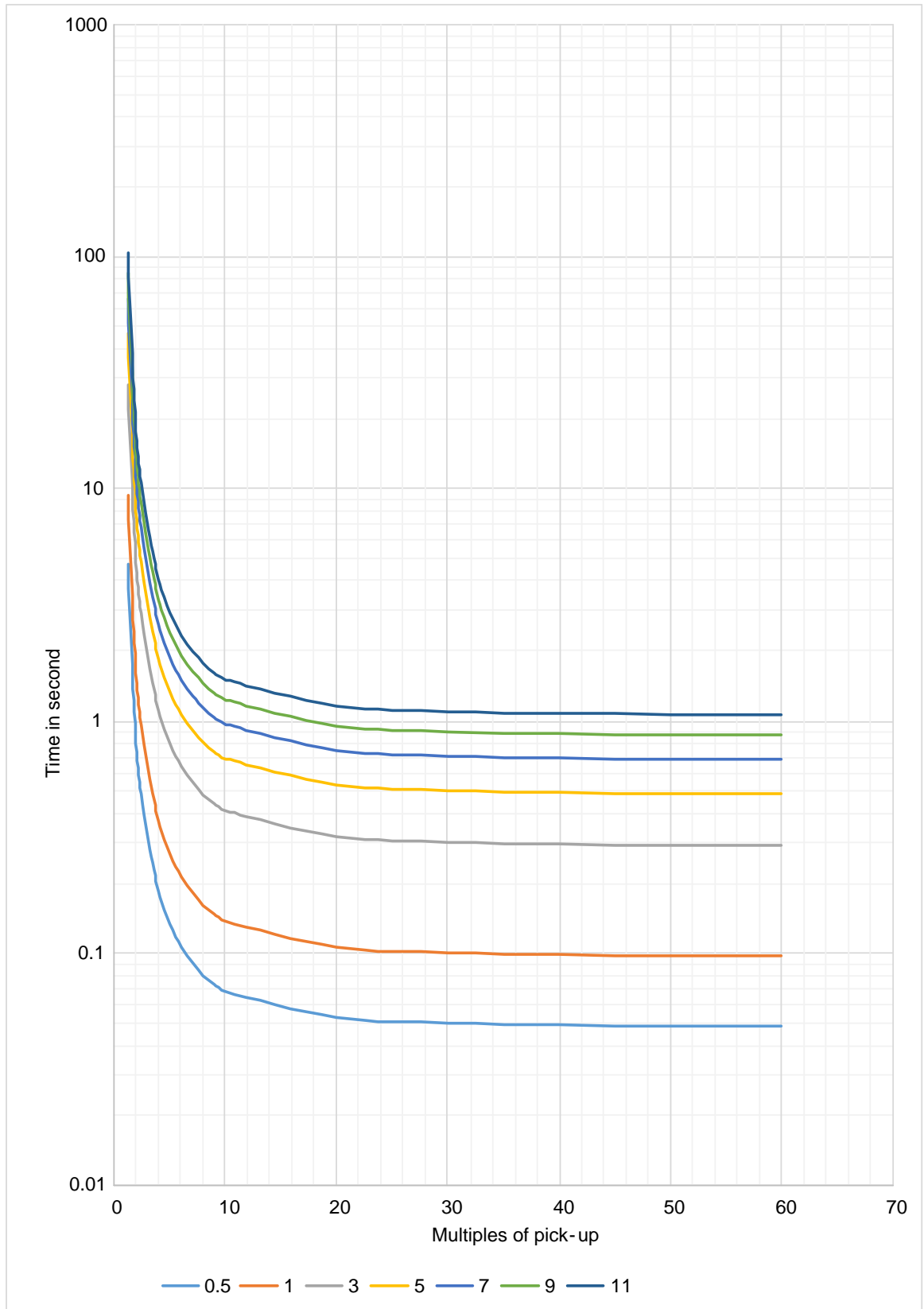


Figure 8-23:.CO-9 Curve (Manufacturer Westinghouse/ABB)

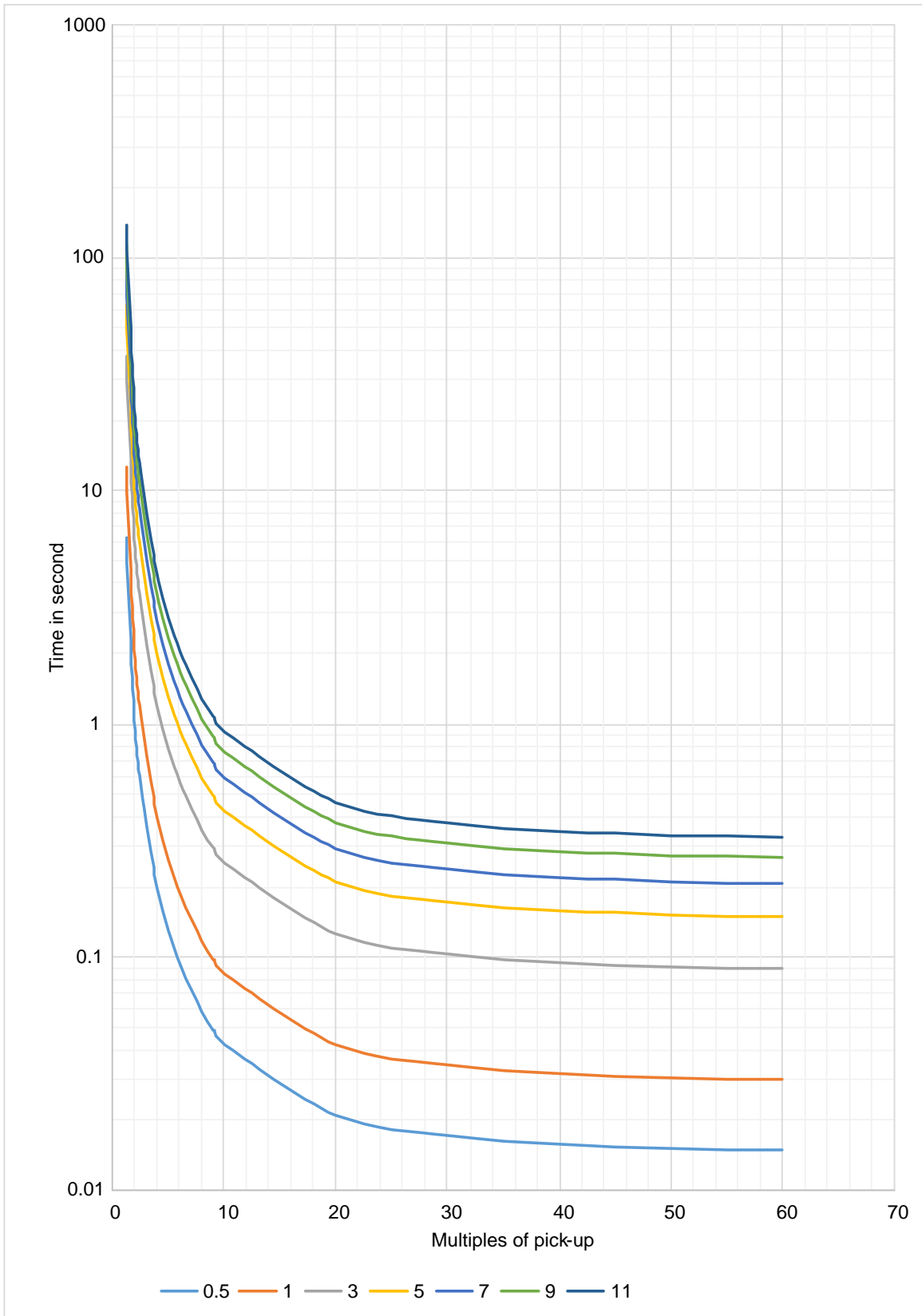


Figure 8-24: CO-11 Curve (Manufacturer: Westinghouse/ABB)

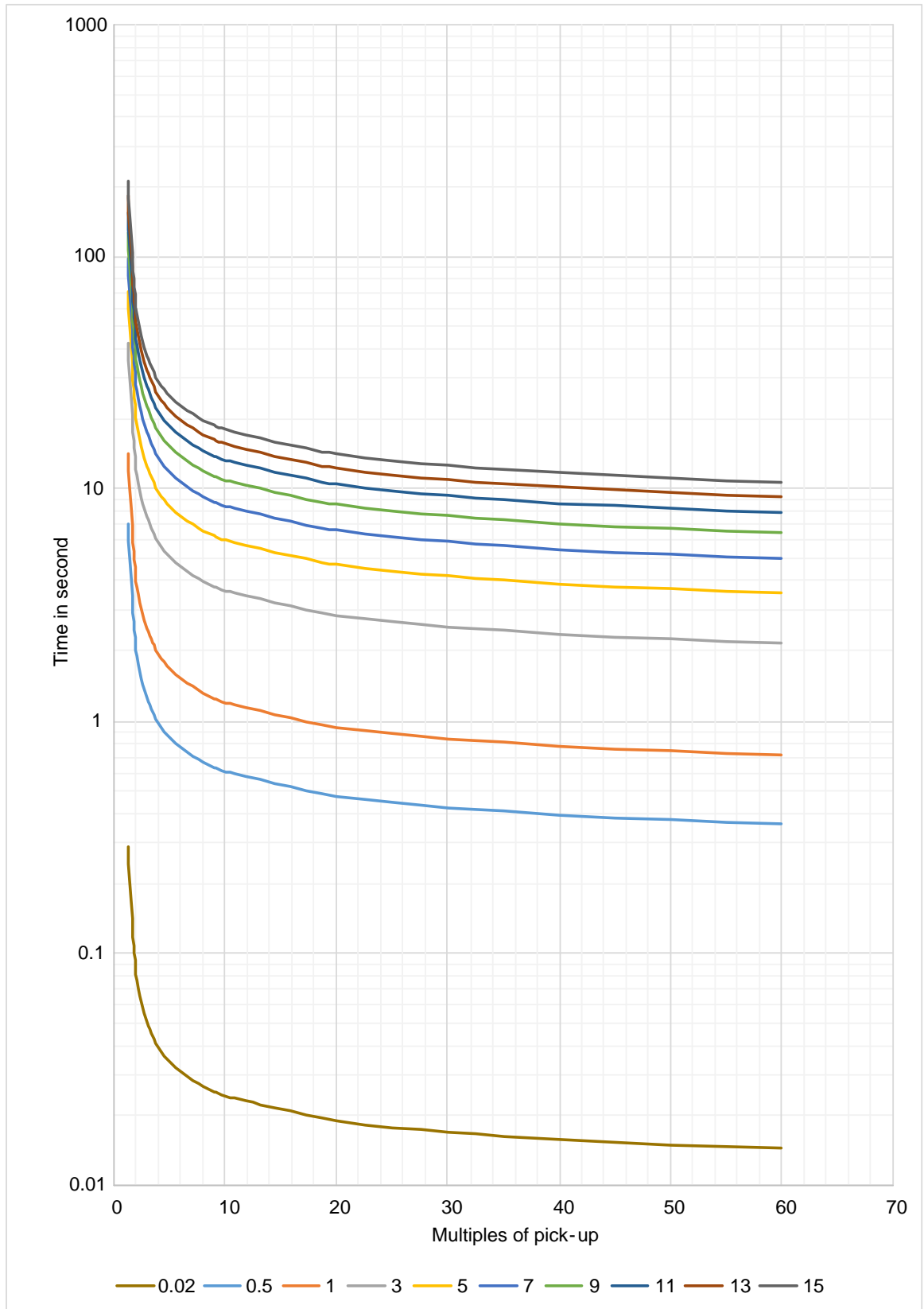


Figure 8-25: IEEE MI Curve (IEEE)

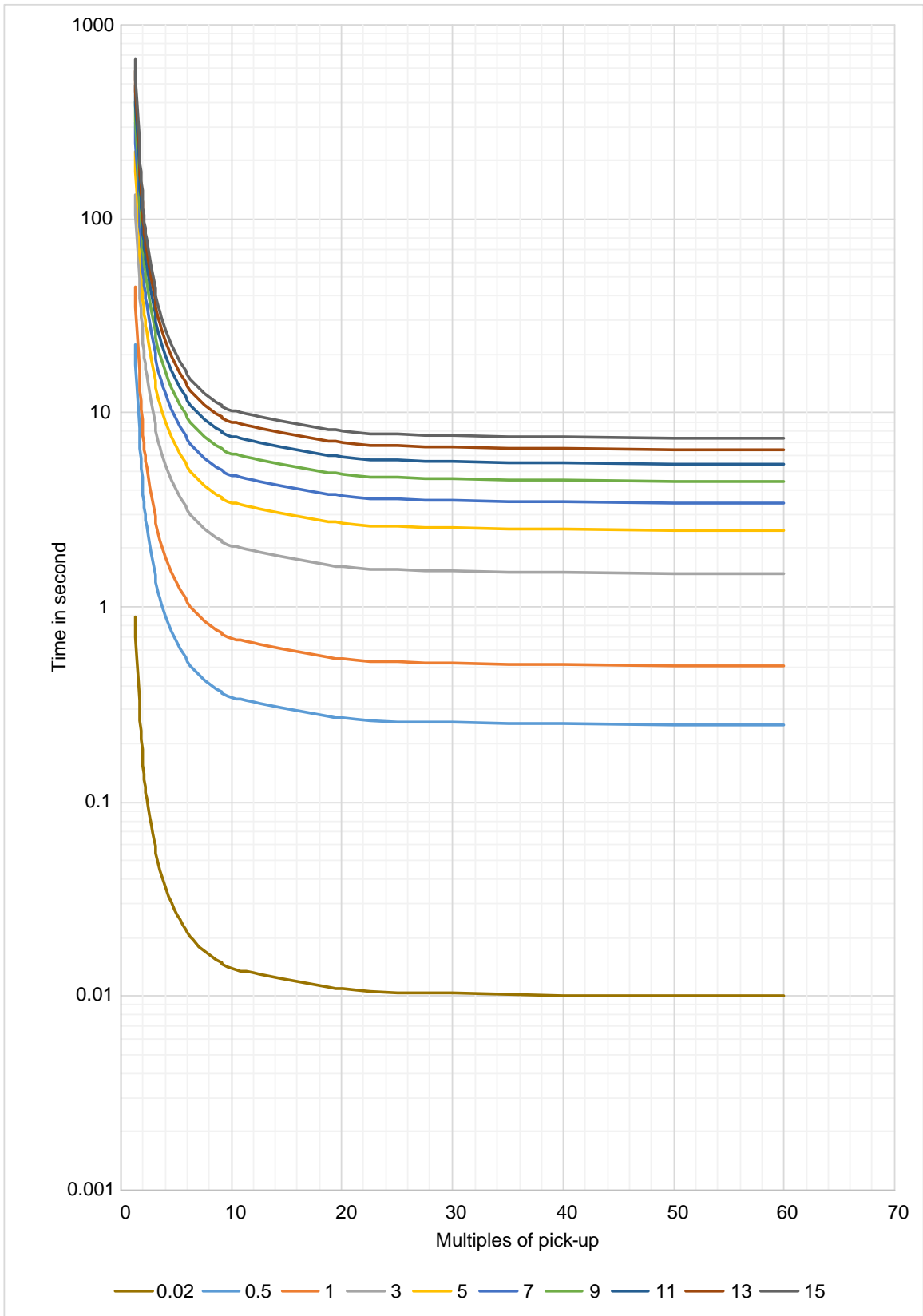


Figure 8-26: IEEE VI Curve (IEEE)

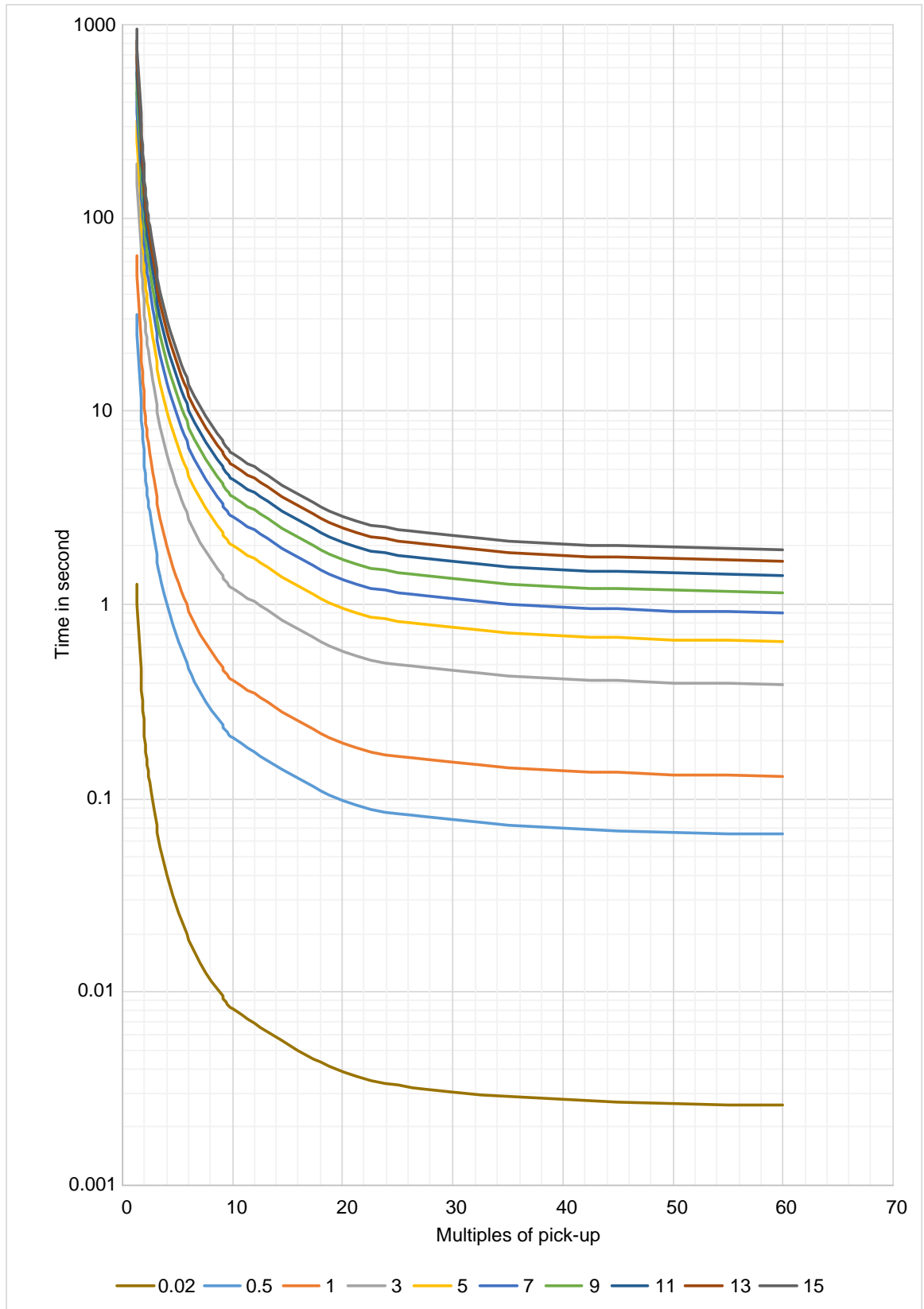


Figure 8-27: IEEE EI Curve (IEEE)

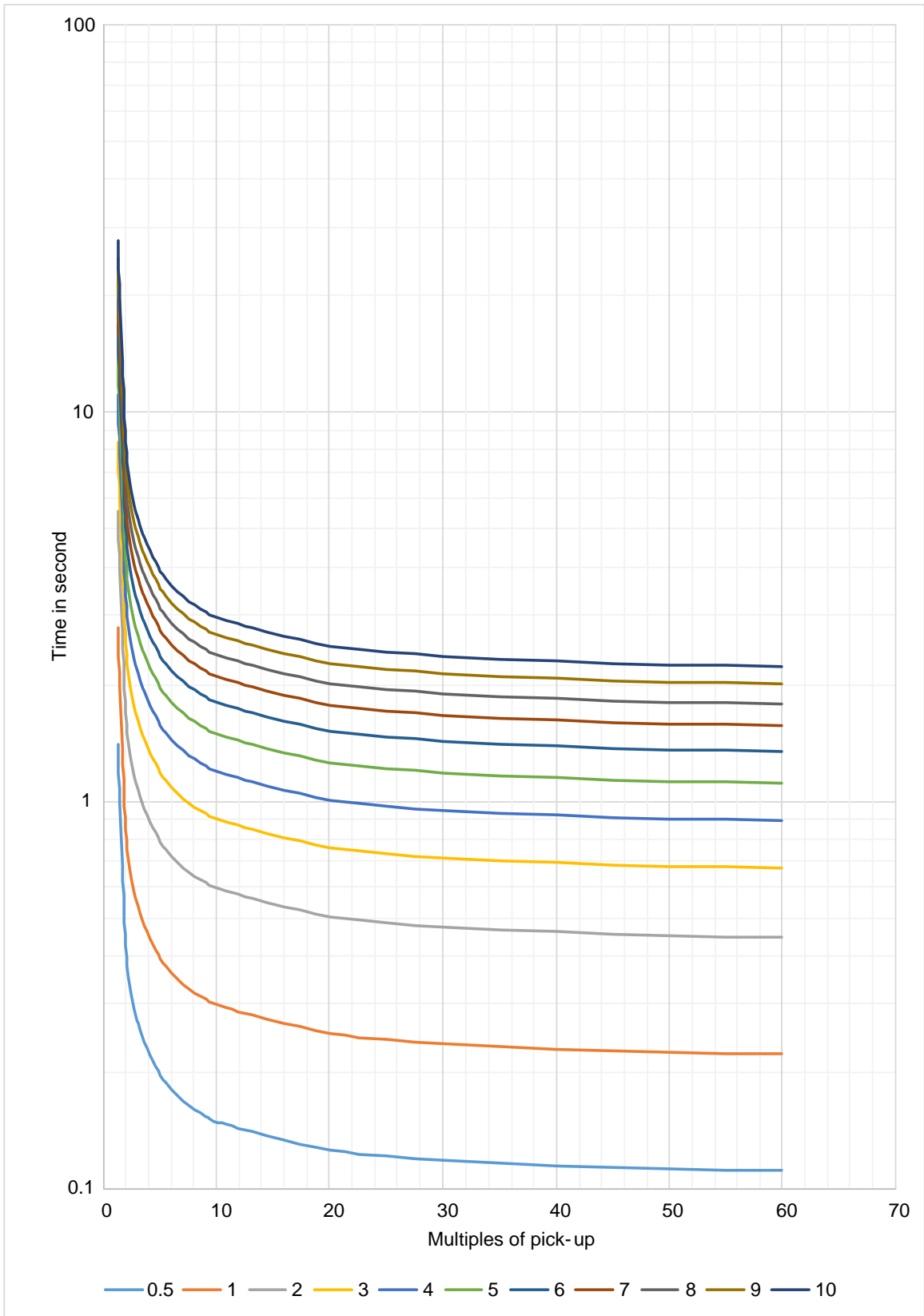


Figure 8-28: IAC51 Curve (Manufacturer: GE)

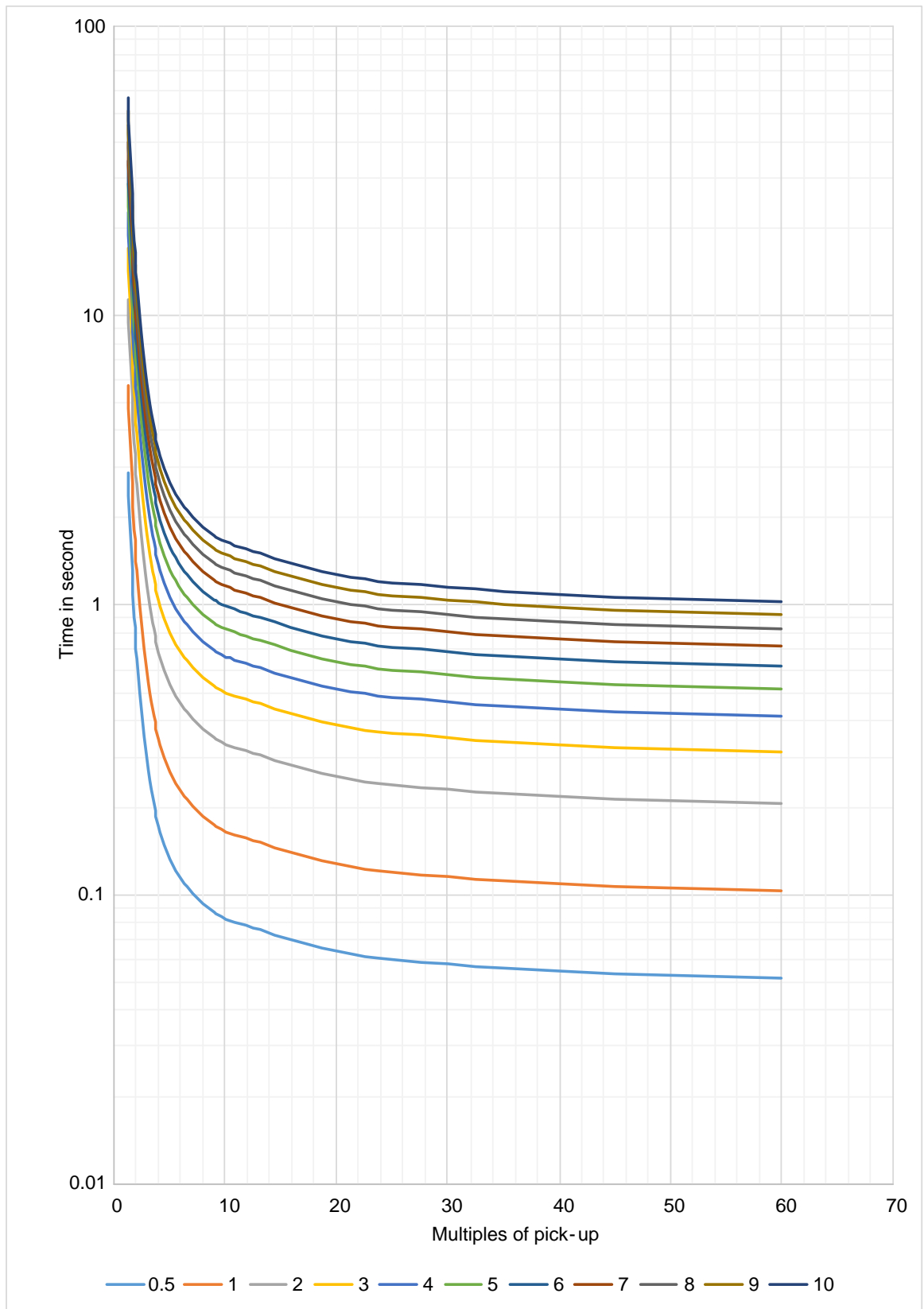


Figure 8-29: IAC53 Curve (Manufacturer: GE)

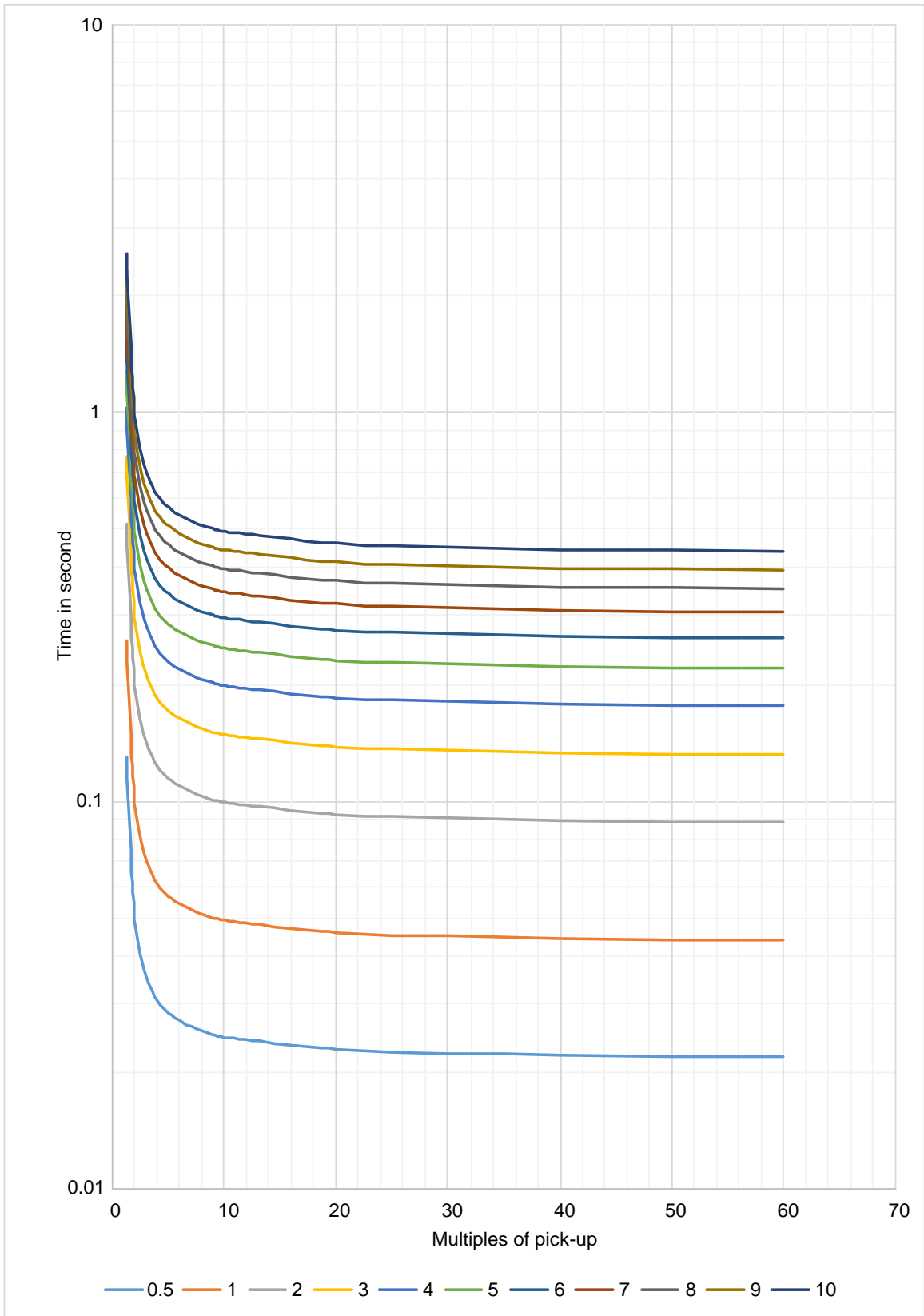


Figure 8-30: IAC55 Curve (Manufacturer: GE)

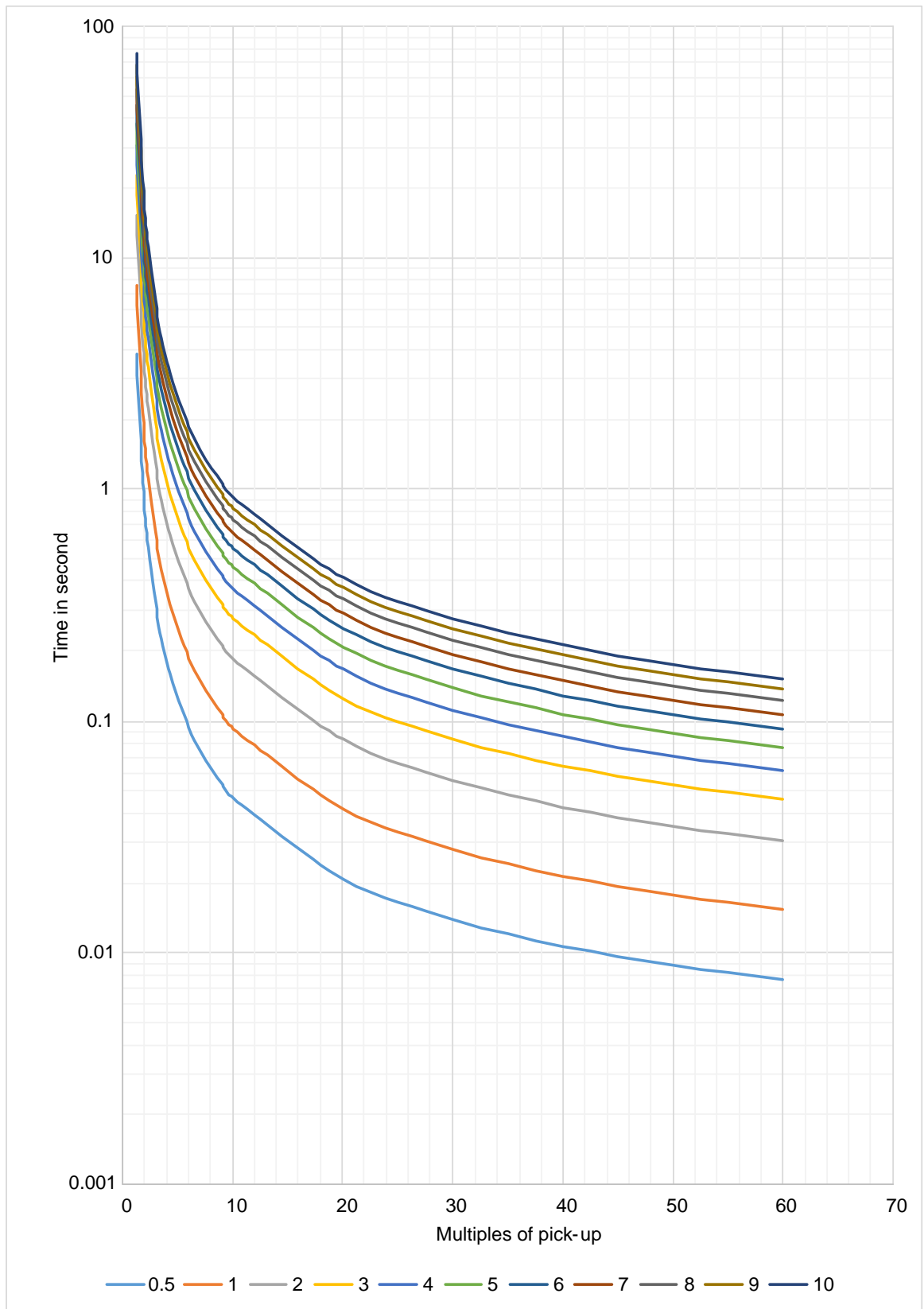


Figure 8-31: IAC77 Curve (Manufacturer: GE)



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Schneider Electric

Customer Care

Phone: 1-800-565-6699

Email: USEnergyTS@schneider-electric.com

www.schneider-electric.com

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