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6.1.3 void AtopSDKSetNetGateway(int eth, char *gateway)
6.1.4 void AtopSDKSetNetDefGateway(int eth)
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1 Preface

1.1 Purpose of the Manual

This manual supports you in understanding the software SDK architecture of ATOP’s SE59XX Series and should be a reference guide for application development on this platform.

1.2 Who Should Use This User Manual

This manual is to be used by qualified programmers, network personnel or support technicians who are familiar with network operations and C Language programming. For any related problems, please contact your local distributor. If they are unable to assist you, please redirect your inquiries to www.atop.com.tw or www.atoponline.com.

1.3 Supported Platform

This manual is designed for the SE5901, SE5901B, SE5904D, SE5908, SE5916, SE5900A, SE5908A, and SE5916A Industrial Serial and Ethernet controller and that model only.

1.4 Warranty Period

ATOP provides a 5-year limited warranty for SE59XX Series.
2 Introduction to Atop SDK

2.1 Overview of SE59XX-SDK development environment

Notice: Please upgrade to the Firmware version on which this SDK document is based.

Figure 2.1 shows the whole architecture of SE59XX SDK. Three types of Applications are provided in user's layer:

1) ATOP applications: providing multiple sample SDK programs to hardware devices
2) ATOP utility: providing firmware upgrade, network settings and storage mounting tools
3) Third-party : providing 3rd parties software required such as SNMP / Apache / SQLite

In Kernel Layer, Linux 3.14.26 is customized to provide complete networking protocols. In Driver Layer, device drivers for all Industrial communication interfaces are provided. In hardware Layer, Customized ARM Cortex-A8 platform and Atop FPGA management core are provided.
### 2.2 Description of SDK Folders

Extract `sdk_release_YYYYMMDD.tar.bz2` and refer `SDK_Release/` folder (please note that `YYYY` corresponds to the release year, `MM` to the release month and `DD` to the release Day).

There are 4 sub-folders:

- **build**: this folder includes build done firmware and merge utilities.
- **filesystem**: this folder includes root file system and bootup script.
- **software**: this folder includes ATOP library, sample code and header file.
- **3rdparty**: 3rd party utilities

The followings are the list of document in "3rdparty" folder:

<table>
<thead>
<tr>
<th>Folder Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Busybox-1.23.1</td>
<td>Busybox source</td>
</tr>
<tr>
<td>c-ares</td>
<td>C library for asynchronous DNS requests</td>
</tr>
<tr>
<td>dhcp-4.1-esv-R13</td>
<td>IPv6 dhcp utilities</td>
</tr>
<tr>
<td>email-3.1.3</td>
<td>E-mail utility</td>
</tr>
<tr>
<td>gmp-6.1.2</td>
<td>gmp-utility – for arbitrary precision arithmetic</td>
</tr>
<tr>
<td>Hostap</td>
<td>user space daemon for access point and authentication servers.</td>
</tr>
<tr>
<td>I2C-tools-3.1.2</td>
<td>I2C tools to manage I2C Bus</td>
</tr>
<tr>
<td>iniparser</td>
<td>Ini file parser library</td>
</tr>
<tr>
<td>iptables-1.6.1</td>
<td>Tool to manage IP tables</td>
</tr>
<tr>
<td>libmodbus-3.1.2</td>
<td>Modbus stack</td>
</tr>
<tr>
<td>libnl-3.2.25</td>
<td>libnl suite is a collection of libraries</td>
</tr>
<tr>
<td>libpcap-1.7.4</td>
<td>a portable C/C++ library for network traffic capture</td>
</tr>
<tr>
<td>libuuid</td>
<td>to generate unique ident for obj to be accessible beyond local system</td>
</tr>
<tr>
<td>monit-5.18</td>
<td>Daemon monitor utility</td>
</tr>
<tr>
<td>mosquitto-1.4.14</td>
<td>MQTT stack</td>
</tr>
<tr>
<td>ncftp-3.2.5</td>
<td>FTP utility</td>
</tr>
<tr>
<td>openssl-1.0.2</td>
<td>Openssl library</td>
</tr>
<tr>
<td>rtl8192EU_linux_v4.4.1.1</td>
<td>Wi-Fi dongle driver.</td>
</tr>
<tr>
<td>strongswan-5.5.2</td>
<td>IPsec VPN</td>
</tr>
<tr>
<td>ucarn-1.5.2</td>
<td>allows 2 host share common virtual IP to provide automatic failover</td>
</tr>
<tr>
<td>wireless_tools.29</td>
<td>Wifi tools</td>
</tr>
<tr>
<td>zlib-1.2.8</td>
<td>Zip library</td>
</tr>
</tbody>
</table>

The followings are the list of application programs in "software" folder:

<table>
<thead>
<tr>
<th>Folder Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>include</td>
<td>Reference header file</td>
</tr>
<tr>
<td>atop_library</td>
<td>ATOP library</td>
</tr>
<tr>
<td>atop_application</td>
<td>Sample code</td>
</tr>
<tr>
<td>libatop.so.1.0.0</td>
<td>ATOP library binary</td>
</tr>
</tbody>
</table>
The followings are the list of application programs in "filesystem" folder:

Table 2.3 List of programs in filesystem folder

<table>
<thead>
<tr>
<th>Folder Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>etc</td>
<td>Bootup script, no need to modify under this folder</td>
</tr>
<tr>
<td>rootfs.tar.bz2</td>
<td>Pre-build root file system.</td>
</tr>
</tbody>
</table>

The followings are the list of application programs in "build" folder:

Table 2.4 Content of build folder

<table>
<thead>
<tr>
<th>Folder Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Image.dld</td>
<td>Build done FW image.</td>
</tr>
<tr>
<td>initrd.uboot</td>
<td>Root file system package</td>
</tr>
<tr>
<td>composer</td>
<td>Merge image utility</td>
</tr>
<tr>
<td>u-boot.bin</td>
<td>Bootloader image for rescuing device</td>
</tr>
<tr>
<td>u-boot.dld</td>
<td>Bootloader image for rescuing device</td>
</tr>
<tr>
<td>zlimage</td>
<td>Linux kernel raw image</td>
</tr>
</tbody>
</table>
2.3 Firmware upgrade

There are two ways to upgrade the firmware on the SE59XX platform:

2.3.1 Use boot-loader update via console port

Prepare a Debug Cable (RJ45 to Serial) and a CAT5E Ethernet cable. Then, follow below figure to connect the Debug port to PC’s COM and CAT5E cable to connect to the Device’s LAN1 Ethernet port to any Host PC’s Ethernet port.

![Figure 2.2 Console firmware update- connections](image)

On your PC, run Windows’ “Super Terminal” setup COM port parameters as follows:
- Port: the connected COM port
- Baud Rate: 115200 bps
- Parity: none
- Data: 8 data bits
- Stop: 1 stop bit
- Flow control: none
With this method, TFTP protocol is used. The TFTP client is already set-up and running inside the SE59XX platform. Thus, the user needs to execute TFTP server in Windows. An open source version is available for download and can be found as “tftpd32”. Screenshot below shows "tftpd32.exe" after running the application.

Now, setup the IP address of the TFTP server. The current folder is the one where "tftpd32.exe" is located. After executing TFTP server, reboot the target SE59XX platform and press the Escape (“Esc”) key immediately. A boot-loader menu will be shown as Figure 2.5.
Select item 1 to enter "LAN Setting" menu as Figure 2.6, and setup IP/Netmask/Gateway of LAN1 as Figure 2.7

Figure 2.6 LAN Settings

Figure 2.7 LAN1 settings

Enter 0 to exit to upper layer menu and select 5 to enter the "TFTP Download" menu, then select 1 to setup TFTP server IP as Figure 2.8

Figure 2.8 TFTP download menu

After the setup of the server IP is completed, select 2 to download the firmware image.

Note: the extension of the firmware should be .dld
2.3.2 Use Device Manager or Device Management Utility

Please use a CAT5E cable to connect SE59XX to a PC running Windows where ATOP Device Management utility is already installed. To install Device Management Utility, please download the latest release from ATOP Website and follow its dedicated user manual for the installation.

The device doesn’t have necessarily to be directly connected to the PC, as long as it is inside the same LAN. Atop Management Utility will scan the whole network automatically.

Now, please power on the device and run Atop’s Device Management Utility from your Host PC. Once the device is running, the utility will list all devices found. If the device doesn’t show up, push the leftmost button (Rescan function). Once identified, select the device by mouse left button and select "Firmware" >> "Download Firmware" as per Figure 2.10.

Select the firmware (Kernel or AP) from this dialog and select the upgraded file as Figure 2.11. Then, click on the "Upgrade" button to upgrade the firmware selected.

Note: This example is made with SE5901A. All other models of SE59XX family share the same method.
Note that the extension file name of upgraded firmware should be .dld

2.4 Verify current firmware version

There are two methods to verify the firmware version:

1) Use a debug line as per Paragraph 2.3.1 above to connect console port of the device. After boot up, type "atop_show_ver" in the console command line to check current version as Figure 1-13 shown. The red rectangle shows information of boot-loader (V1.00), Kernel(V1.00) and AP (V1.00) version number.

2) Use Device Manager or Device Management Utility (Serial Manager) to check version number as per Figure 2.13. (Device Manager is currently supported to Simplified Chinese release)
2.5 Installing a Cross-Compiler

1) Copy ti-am335x-linux-devkit-08.00.00.00.tar.gz to /opt folder and extract it. Be sure that you have and use the root account to do it. This user manual is made with this version. If a newer, stable version is available, the SDK package will include it.

   \texttt{tar zxf /ti-am335x-linux-devkit-08.00.00.00.tar.gz /opt}

2) Add these environment variable

   \texttt{export ARCH=arm}
   \texttt{export PATH=/opt/ti-am335x-linux-devkit-08.00.00.00/bin:$PATH}
   \texttt{export CROSS_COMPILE=arm-linux-gnueabihf}

2.6 Compiling Procedure for Atop Applications

To compile ATOP application, in SDK root folder, please enter

\texttt{make clean} clear all .o object and executable files
\texttt{make release platform=am335x_v8} compile and link the source code

After build done, you can find your image under build folder be named Image.dld.

2.7 Compiling new Applications

1) Put the source code under /software/atop_application/utils/<YOUR_APP_FOLDER> folder. <YOUR_APP_FOLDER> is a name chosen by yourself. (such as “Test”)

2) Follow Paragraph 2.6 above to build your application or modify "Makefile" following the /atop_sdk.
## 2.8 Download new Applications to the device

New applications can be downloaded in two ways:

### 2.8.1 Using TFTP protocol

- Please execute tftpd32.exe in the remote PC and modify target folder and IP address as Figure 2.8
- Login into the target device (under Linux console) and enter:

```
tftp -gr YOUR_APP_NAME YOUR_TFTP_SERVER_IP
```

Remember to use "chmod" command to modify the access attributes of these files. If transmission failed, please check the networking connection.

### 2.8.2 Using FTP protocol

- Setup or read FTP account and password from Atop boot-loader menu as per image below.

```
[0] Reboot
[1] LAN Settings
[2] DNS Settings
[4] Device Info
[5] FTPP Download
[6] Hardware Diagnostic
```

Figure 2.14 FTP access credentials

- Login the Linux system in order to make sure the network connection is fine.
  Use any 3rd party ftp software to transfer the files. For example, use FileZilla as

```
Host: 192.168.4.123  Username: admin  Password:  Port:  Quickconnect
```

Figure 2.15 FTP Download with FileZilla

- Input FTP account / password of SE59XX and login to the FTP server.

Note: Make sure the binary mode to be set during the transmission.

Remember to use "chmod" command to modify the access attribute of these files. If transmission failed, please check the networking connection okay or not between SE59XX platform and Host PC.
2.9 Login or Remote Login to the device

2.9.1 Remote Login
1) Setup or read FTP account and password from Atop boot-loader menu as Figure 1-16
2) Use any tools supporting the telnet protocol such as “ssh” inside of Windows.
3) Enter `SE59XX_TARGET_IP` via ssh using software putty.
4) Login account as first step shown.

2.9.2 Use a debug command line to Login
If you’re not pressing “Esc” button within 3 seconds from boot-up, the device will enter Linux login mode as per screenshot below

```
Welcome to ATOP system
ATOP login: [ 8.975831] libphy: 4s101000.mdio:02 - Link is Up - 100/Full
[ 8.985210] IPv6: ADDRCONF(NETDEV_CHANGE); eth0: link becomes ready
Welcome to ATOP system
ATOP login: *
```

Figure 2.16 Command line Login

2.10 Automatic execution on Startup of Custom-Applications

1) Put your startup script “user_pre.sh or user_post.sh” into /jffs2 of root file system via FTP or TFTP.
2) SE5904D will execute both user_pre.sh and user_post.sh” after startup from next reboot.
2.11 Startup messages

The following is the standard startup message from SE5904D (as example):


I2C: ready
DRAM: 512 MiB
Flash: 32 MiB
MMC: OMAP SD/MMC: 0, OMAP SD/MMC: 1
*** Warning - bad CRC, using default environment

Net: cpsw
Hit ESC to execute ATOP menu:
Wait ... 0

Booting from ramdisk ...
Kernel image @ 0x82000000 [ 0x0000000 - 0x383458 ]
## Loading init Ramdisk from Legacy Image at 84080000 ...

** U-Boot 2014.07-svn286 [ 0x0000000 - 0x383458 ]
I2C:   ready
DRAM:  512 MiB
Flash: 32 MiB

** Warning bad CRC, using default environment

Net: cpsw
Hit ESC to execute ATOP menu:
Wait ... 0

** Booting from ramdisk ...
Kernel image @ 0x82000000 [ 0x0000000 - 0x383458 ]
## Loading init Ramdisk from Legacy Image at 84080000 ...

** U-Boot 2014.07-svn286 [ 0x0000000 - 0x383458 ]
I2C:   ready
DRAM:  512 MiB
Flash: 32 MiB

** Warning bad CRC, using default environment

Net: cpsw
Hit ESC to execute ATOP menu:
Wait ... 0

** Loading init Ramdisk from Legacy Image at 84080000 ...

Image Name: RootFS
Created:      2017-02-15 5:38:49 UTC
Image Type:   ARM Linux RAMDisk Image (gzip compressed)
Data Size:    6787658 Bytes = 6.5 MiB
Entry Point:  00000000

## Loading init Ramdisk from Legacy Image at 84080000 ...

Im
eage Name:   RootFS
Created:      2017-02-15 5:38:49 UTC
Image Type:   ARM Linux RAMDisk Image (gzip compressed)
Data Size:    6787658 Bytes = 6.5 MiB
Entry Point:  00000000

## Loading init Ramdisk from Legacy Image at 84080000 ...

Image Name: RootFS
Created:      2017-02-15 5:38:49 UTC
Image Type:   ARM Linux RAMDisk Image (gzip compressed)
Data Size:    6787658 Bytes = 6.5 MiB
Entry Point:  00000000

## Loading init Ramdisk from Legacy Image at 84080000 ...

Image Name: RootFS
Created:      2017-02-15 5:38:49 UTC
Image Type:   ARM Linux RAMDisk Image (gzip compressed)
Data Size:    6787658 Bytes = 6.5 MiB
Entry Point:  00000000

## Flattened Device Tree blob at 84000000
Booting using the fdt blob at 0x84000000
Loading Ramdisk to 87986000, end 87fff24a ... OK
Loading Device Tree to 8797a000, end 879850fe ... OK
Starting kernel ...

Virtual kernel memory layout:

Virtual kernel memory layout:

Virtual kernel memory layout:

Virtual kernel memory layout:

Virtual kernel memory layout:

Virtual kernel memory layout:
Introduction to Atop SDK

User Manual

0.006470  pid_max: default: 32768 minimum: 301
0.006570  Security Framework initialized
0.006626  Mount-cache hash table entries: 1024 (order: 0, 4096 bytes)
0.006638  Mountpoint-cache hash table entries: 1024 (order: 0, 4096 bytes)
0.006914  CPU: Testing write buffer coherency: ok
0.013453  CPU: Testing write buffer coherency: ok
0.013874  Setting up static identity map for 0x804a8630 - 0x804a86a0
0.015073  devtmpfs: initialized
0.022954  CPU: Testing write buffer coherency: ok
0.023029  omap_hwmod: tptc0 using broken dt data from edma
0.023093  omap_hwmod: tptc1 using broken dt data from edma
0.027050  omap_hwmod: tptc2 using broken dt data from edma
0.080891  pinctrl core: initialized pinctrl subsystem
0.082028  regulator-dummy: no parameters
0.083870  NET: Registered protocol family 16
0.085286  DMA: preallocated 256 KiB pool for atomic coherent allocations
0.087423  cpuidle: using governor menu
0.087438  cpuidle: using governor menu
0.095936  platform 49000000.edma: alias fck already exists
0.095960  platform 49000000.edma: alias fck already exists
0.095972  platform 49000000.edma: alias fck already exists
0.097087  OMAP GPIO hardware version 0.1
0.106842  omap_gpmc 50000000.gpmc: could not find pctldev for node /pinmux@44e10800/norflash_pins_default, deferring probe
0.106875  omap_gpmc 50000000.gpmc: could not find pctldev for node /pinmux@44e10800/norflash_pins_default, deferring probe
0.106875  omap_gpmc 50000000.gpmc: could not find pctldev for node /pinmux@44e10800/norflash_pins_default, deferring probe
0.106911  omap_gpmc 50000000.gpmc: could not find pctldev for node /pinmux@44e10800/norflash_pins_default, deferring probe
0.106911  omap_gpmc 50000000.gpmc: could not find pctldev for node /pinmux@44e10800/norflash_pins_default, deferring probe
0.106911  omap_gpmc 50000000.gpmc: could not find pctldev for node /pinmux@44e10800/norflash_pins_default, deferring probe
0.106875  omap_gpmc 50000000.gpmc: could not find pctldev for node /pinmux@44e10800/norflash_pins_default, deferring probe
0.106875  omap_gpmc 50000000.gpmc: could not find pctldev for node /pinmux@44e10800/norflash_pins_default, deferring probe
0.106875  omap_gpmc 50000000.gpmc: could not find pctldev for node /pinmux@44e10800/norflash_pins_default, deferring probe
0.106875  omap_gpmc 50000000.gpmc: could not find pctldev for node /pinmux@44e10800/norflash_pins_default, deferring probe
0.106875  omap_gpmc 50000000.gpmc: could not find pctldev for node /pinmux@44e10800/norflash_pins_default, deferring probe
0.110401  OMAP GPIO hardware version 0.1
0.110420  hw_breakpoint: debug architecture 0x4 unsupported.
0.127584  bio: create slab <bio-0> at 0
0.141124  omap-mailbox 44e0b000.i2c: could not find pctldev for node /pinmux@44e10800/pinmux_i2c0_pins, deferring probe
0.141124  omap-mailbox 44e0b000.i2c: could not find pctldev for node /pinmux@44e10800/pinmux_i2c0_pins, deferring probe
0.141124  omap-mailbox 44e0b000.i2c: could not find pctldev for node /pinmux@44e10800/pinmux_i2c0_pins, deferring probe
0.141124  omap-mailbox 44e0b000.i2c: could not find pctldev for node /pinmux@44e10800/pinmux_i2c0_pins, deferring probe
0.141124  omap-mailbox 44e0b000.i2c: could not find pctldev for node /pinmux@44e10800/pinmux_i2c0_pins, deferring probe
0.141124  omap-mailbox 44e0b000.i2c: could not find pctldev for node /pinmux@44e10800/pinmux_i2c0_pins, deferring probe
0.141124  omap-mailbox 44e0b000.i2c: could not find pctldev for node /pinmux@44e10800/pinmux_i2c0_pins, deferring probe
[1.050604] omap_rng 48310000.rng: OMAP Random Number Generator ver. 20
[1.068218] brd: module loaded
[1.076954] loop: module loaded
[1.080664] (hci_tty): inside hci_tty_init
[1.085470] (hci_tty): allocated 251, 0
[1.096657] 2000020.atop_relay:
[1.100095] Register atop_relay0 success.
[1.105516] 200000e.atop_cpld:
[1.108659] Register atop_cpld_ver0 success.
[1.115365] mtdoops: mtd device (mtdev=number) must be supplied
[1.112543] usbcare: registered new interface driver cdc_ether
[1.116858] platform musb-hdrc.0.auto: Driver musb-hdrc requests probe deferred
[1.119693] 47410b00.usb phy-vcc not found, using dummy regulator
[1.121478] musb-hdrc musb-hdrc.1.auto: musb_init_controller failed with status -517
[1.122065] platform musb-hdrc.1.auto: Driver musb-hdrc requests probe deferred
[1.124698] input: beeper.7 as /devices/beeper.7/input/input0
[1.125012] omap_rtc 44e3e000.rtc: rtc core: registered 44e3e000.rtc as rtc0
[1.125807] i2c /dev entries driver
[1.126433] oprofile: using arm/armv7
[1.126847] TCP: cubic registered
[1.127197] Initializing XFRM netlink socket
[1.127652] NET: Registered protocol family 10
[1.128207] sit: IPv6 over IPv4 tunneling driver
[1.128918] NET: Registered protocol family 17
[1.131779] 47401b00.usb phy-vcc not found, using dummy regulator
[1.132012] omap_rtc 44e3e000.rtc: rtc core: registered 44e3e000.rtc as rtc0
[1.132580] i2c /dev entries driver
[1.133887] lis3_reg: disabling
[1.133923] regulator-dummy: disabling
[1.134358] omap-gpmc 50000000.gpmc: GPMC revision 6.0
[1.134906] gpmc_mem_init: disabling cs 0 mapped at 0x0
[1.135721] spanion:s29gl256p11t: Found 1 x16 devices at 0x0 in 16-bit bank. Manufacturer ID 0x000001 Chip ID 0x002201
[1.136858] Amad/Fujitsu Extended Query Table at 0x0
[1.137402] Amad/Fujitsu Extended Query version 1.3.
[1.137931] Advanced Sector Protection (PPB Locking) supported
[1.138562] number of CFI chips: 1
[1.138956] 6 ofpart partitions found on MTD device spanion:s29gl256p11t
[1.139663] Creating 6 MTD partitions on "spansion,s29gl256p11t":
[1.140300] 0x000000600000 : "DTB"
[1.140937] 0x000000100000 : "jffs2"
[1.141698] 0x0000000a0000 : "kernel"
[1.142378] 0x1000000 : "u-boot env"
[1.143032] 0x000000100000 : "roofs"
[1.143674] 0x000000010000 : "sysfs"
[1.144677] at24 0 0050: 8192 byte 24cs64 EEPROM, writable, 1 bytes/write
[1.164744] rtc=pcf8563 0-0051: chip found, driver version 0.4.3
[1.165351] rtc=pcf8563 0-0051: low voltage detected, date/time is not reliable.
[1.166174] rtc=pcf8563 0-0051: rtc core: registered rtc=pcf8563 as rtc1
[1.166875] omap_i2c: 44e0b000.12c: bus 0 rev.011 at 400 kHz
[1.167543] omap_i2c: 4802a000.21c: bus 1 rev.011 at 100 kHz
[1.168059] musb-hdrc musb-hdrc.0.auto: MUSB HDRC host driver
[1.169113] musb-hdrc musb-hdrc.0.auto: new USB bus registered, assigned bus number 1
[1.169960] usb1: New USB device found, idVendor=1d6b, idProduct=0002
[1.170657] usb1: New USB device strings: Mfr=3, Product=2, SerialNumber=1
[1.171438] usb1: Product: MUSB HDRC host driver
[1.172596] usb1: SerialNumber: musb-hdrc.0.auto

SE59XX-SDK
Software development Kit
User Manual
Introduction to Atop
SDK
UTF-8 byte order mark detected

Enabling support for engine "capi"

error queue: 2606A074: error:2606A074:engine routines:ENGINE_by_id:no such engine


Line 18: "engine = capi": Failed to open the engine

FAIL

Starting network management services: snmpd.

Welcome to ATOP system

ATOP login:
3 Hardware Specifications

3.1 Packing List

Inside the purchased package, you will find the following items:

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE59XX</td>
<td>1</td>
<td>Industrial Serial Device Server</td>
</tr>
<tr>
<td>Mounting Kit</td>
<td>1</td>
<td>On SE5908 / SE5916 / SE5908A / SE5916A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rack Mounting Type-L angles x 2(</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Screws x 6(</td>
</tr>
<tr>
<td></td>
<td></td>
<td>On SE5901 / SE5904D / SE5901B - DIN Rail Kit</td>
</tr>
<tr>
<td>Terminal Block</td>
<td></td>
<td>Power Supply/ Relay output:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TB3 x 1: 3-pin 5.08mm lockable Terminal Block (SE5901, SE5901B)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TB3 x 2: 3-pin 5.08mm lockable Terminal Block (SE5908-DC,SE5916-DC)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TB7 x 1: 7-pin 5.08mm lockable Terminal Block (SE5904D only)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Serial ports: Terminal block is included only on TB model</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TB5 x 1: 5-pin 5.08mm lockable Terminal Block (SE5901)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TB5 x 4: 5-pin 5.08mm lockable Terminal Block (SE5904D)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TB5 x 8: 5-pin 5.08mm lockable Terminal Block (SE5908A)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TB5 x 16: 5-pin 5.08mm lockable Terminal Block (SE5916A)</td>
</tr>
<tr>
<td>Documentation</td>
<td>1</td>
<td>Hardware Installation Guide )Warranty card is included(</td>
</tr>
<tr>
<td>Mounting Kit</td>
<td>1</td>
<td>DIN-Rail Kit (Already mounted on the device)</td>
</tr>
</tbody>
</table>

Note: Please notify your sales representative if any of the above items is missing or damaged in any form upon delivery. If your sales representative is unable to satisfy your enquiries, please contact us directly.

3.2 Optional Accessories

The following table lists optional accessories for SE59XX SDK series.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN315-1212(US-LDC)</td>
<td>Y-Type (5.08mm) power adapter, 100-240VAC input, 1.25A @ 12VDC output, US plug</td>
</tr>
<tr>
<td>UNE315-1212(EU-LDC)</td>
<td>Y-Type (5.08mm) power adapter, 100-240VAC input, 1.25A @ 12VDC output, EU plug</td>
</tr>
<tr>
<td>ADP-DB9(F)-TB5</td>
<td>Female DB9 to Female 3.81 TB5 Converter</td>
</tr>
<tr>
<td>CBL-RJ45(8P)-DB9(F)</td>
<td>8-pin RJ45-DB9 debug cable, 90cm</td>
</tr>
<tr>
<td>GDC-120</td>
<td>120mm copper woven grounding cable</td>
</tr>
<tr>
<td>LM28-C3S-TI-N</td>
<td>SFP Transceiver, 1250Mbps, 850nmVCSEL, Multi-mode, 550m, 3.3V, -20~85°C</td>
</tr>
<tr>
<td>LM38-C3S-TI-N</td>
<td>SFP Transceiver, 1250Mbps, 1310nmFP, Multi-mode, 2km, 3.3V, -40~85°C</td>
</tr>
<tr>
<td>LS38-C3S-TI-N</td>
<td>SFP Transceiver, 1250Mbps, 1310nmFP, Single-mode, 10km, 3.3V, -40~85°C</td>
</tr>
<tr>
<td>LS38-C3L-TI-N</td>
<td>SFP Transceiver, 1250Mbps, 1310nmDFB, Single-mode, 30km, 3.3V, -40~85°C</td>
</tr>
<tr>
<td>WMK-450-Black</td>
<td>Black Aluminum Wall Mount Kit (DIN-rail items only)</td>
</tr>
</tbody>
</table>
## 3.3 Hardware

Table 3.3 Hardware features

<table>
<thead>
<tr>
<th>System</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CPU</strong></td>
<td>32-bit ARM Based TI CPU AM3354 800MHz (except SE5908A/SE5916A use AM3352 1GHz)</td>
</tr>
<tr>
<td><strong>Flash Memory</strong></td>
<td>32MB</td>
</tr>
<tr>
<td><strong>RAM</strong></td>
<td>SE5901 DDR2 128MB</td>
</tr>
<tr>
<td></td>
<td>SE5901B DDR2 256MB</td>
</tr>
<tr>
<td></td>
<td>SE5904D DDR3 256MB</td>
</tr>
<tr>
<td></td>
<td>SE5900A/08A/16A/MB5908/16 DDR3 256MB</td>
</tr>
<tr>
<td><strong>EEPROM</strong></td>
<td>8 KB</td>
</tr>
<tr>
<td><strong>Reset</strong></td>
<td>Built-in Recessed Key (Restore to Factory Defaults)</td>
</tr>
<tr>
<td><strong>Watchdog</strong></td>
<td>Hardware built-in</td>
</tr>
</tbody>
</table>

**Network**

<table>
<thead>
<tr>
<th>Ethernet Interface</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IEEE 802.3 10BaseT</td>
</tr>
<tr>
<td></td>
<td>IEEE 802.3u 100BaseT(X)</td>
</tr>
<tr>
<td></td>
<td>IEEE 802.3ac 1000BaseT(X) – SFP version of SE5904D only</td>
</tr>
<tr>
<td></td>
<td>IEEE 802.3af (PoE PD) – selected SE5901 and SE5904D versions can be powered through PoE</td>
</tr>
<tr>
<td></td>
<td>Connection: SFP or RJ45</td>
</tr>
</tbody>
</table>

**Serial**

<table>
<thead>
<tr>
<th>Serial Interface</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RS-232/RS-422/RS-485 Software Selectable (Default: RS-232)</td>
</tr>
<tr>
<td></td>
<td>• The first port available on SE5901B is RS-232/RS-485</td>
</tr>
<tr>
<td></td>
<td>• The second port available on SE5901B-IO-X is only RS-232</td>
</tr>
<tr>
<td></td>
<td>• The isolation version (-SiS) on SE5908/SE5916/SE5908A/SE5916A supports only RS-422/ RS-485</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Serial Connector</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Connector Type</td>
</tr>
<tr>
<td></td>
<td>• SE5916 -16 Serial Ports (RJ45)</td>
</tr>
<tr>
<td></td>
<td>• SE5908 - 8 Serial Ports (RJ45)</td>
</tr>
<tr>
<td></td>
<td>• SE5916A – 16 Serial Ports (TB-5 or DB-9)</td>
</tr>
<tr>
<td></td>
<td>• SE5908A – 8 Serial Ports (TB-5 or DB-9)</td>
</tr>
<tr>
<td></td>
<td>• SE5904 – 4 Serial Ports (TB-5 or DB-9)</td>
</tr>
<tr>
<td></td>
<td>• SE5901 – 1 Serial Port (TB-5 or DB-9)</td>
</tr>
<tr>
<td></td>
<td>• SE5901B – 1 Serial Port (TB-14 or DB-9) – includes I/O</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Protection</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SE5901/SE5901B no isolation</td>
</tr>
<tr>
<td></td>
<td>SE5904D/ SE5908A/16A (optional 3V)</td>
</tr>
<tr>
<td></td>
<td>SE5908/16 (optional 2.5kV)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Serial Port Communication</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baud-rate: 1200 bps ~ 921600 bps</td>
</tr>
<tr>
<td></td>
<td>Parity: None, Even, Odd, Mark, or Space</td>
</tr>
<tr>
<td></td>
<td>Data Bits: 5, 6, 7, 8</td>
</tr>
<tr>
<td></td>
<td>Stop Bits: 1, 2 Software Selectable</td>
</tr>
<tr>
<td></td>
<td>Flow Control: RTS/CTS (RS-232 only), XON/XOFF, None</td>
</tr>
</tbody>
</table>

**LED Indicator**

<table>
<thead>
<tr>
<th>LED indication</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Power x 2 (SE5901- SE5901B – SE5908 – SE5916 x 1)</td>
</tr>
<tr>
<td></td>
<td>RUN x 1</td>
</tr>
<tr>
<td></td>
<td>ALARM x 1</td>
</tr>
<tr>
<td></td>
<td>LAN:</td>
</tr>
<tr>
<td></td>
<td>• x 2 (all versions except SE5908A and SE5916A)</td>
</tr>
<tr>
<td><strong>COM port:</strong></td>
<td>x 6 (SE5908A and SE5916A only)</td>
</tr>
<tr>
<td></td>
<td>COM port:</td>
</tr>
<tr>
<td></td>
<td>x 16 (SE5916 and SE5916A);</td>
</tr>
<tr>
<td></td>
<td>x 8 (SE5908 and SE5908A);</td>
</tr>
<tr>
<td></td>
<td>x 4 (SE5904D);</td>
</tr>
<tr>
<td></td>
<td>x 1 (SE5901 and SE5901B)</td>
</tr>
</tbody>
</table>

### Power Requirement & EMC

| **Input** | SE5908 / SE5916: |
| | Single 100–240 VAC (EU/US versions) |
| | Single 24–48 VDC (DC version) |
| | SE5908A / SE5916A |
| | Redundant 100–240 VAC or 100–370 VDC (TB) – HV vers. |
| | Redundant 24–48 VDC – DC version |
| | SE5901/SE5901B: Single 9–48 VDC |
| | SE5904D: Redundant 9–48 VDC |

| **Consumption** | Max. 17.5 W (SE5908 / SE5916) |
| | Max. 6W (SE5901) |
| | Max. 7.8W(SE5904D) |
| | Max. 17.5W(SE5908A/SE5916A) |
| | Max. 7.2W(SE5901B) |

| **EMI/EMC** | FCC Part 15, Subpart B, Class A |
| | EN 55032, Class B, EN 61000-6-2, Class B |
| | EN 61000-3-2, EN 61000-3-3 |
| | EN 55024, EN 61000-6-4 |
| | IEC 61850-3 / IEEE 1613 (SE5908A and SE5916A only) |

### Mechanical

| **Dimensions (W x H x D, mm)** | SE5901: 32 mm x 110 mm x 90 mm (1.26 x 4.33 x 3.54 in) |
| | SE5901B: 32 mm x 122mm x 92 mm (1.26 x 4.8 x 3.62 in) |
| | SE5904D: 55 mm x 145 mm x 113mm (2.17 x 5.71 x 4.45 in) |
| | SE5908: 436 mm x 43.5 mm x 200 mm (17.17 x 1.71 x 7.87 in) |
| | SE5916: 436 mm x 43.5 mm x 200 mm (17.17 x 1.71 x 7.87 in) |
| | SE5908A: 440.6mm x 44 mm x 309 mm (17.35 x 1.73 x 12.17 in) |
| | SE5916A: 440.6mm x 44 mm x 309 mm (17.35 x 1.73 x 12.17 in) |
| **Enclosure** | IP30 protection, metal housing |

### Environmental

| **Temperature** | Operations |
| | -40°C ~ 85°C (-40°F ~ 185°F) |
| | (except SE5901B -40°C ~ 70°C and SE5908/SE5916 -20°C ~ 70°C) |
| **Storage** | -40°C ~ 85°C (-40°F ~ 185°F) |
| **Relative Humidity** | 5% ~ 95%, 55°C Non-condensing |
3.4 **External Device's Overview**

The following figures show particular SE59XX series device’s front and rear panels.

**SE5901**

**SE5904D**

- RJ45 DB9 Type
- RJ45 TB5 Type
- SFP DB9 Type
- SFP TB5 Type
SE5901B

SE5908/16

- Reset button
- LCM Display
- LCM buttons
- Power cord connection and switch
- Relay Output
- Serial Port 1-8
- Serial Port 9-16
- LAN Port 1-2

Dimensions:
- 436.0 x 43.5
- 11.8 x 14.5
SE5908A/16A
3.5 Serial Pin Assignments

3.5.1 SE5901 Pin Assignments for Serial Interfaces
DB9 to RS-232/RS-422/RS-485 connectors

![DB9 Pin Number](image)

Figure 3.1 DB9 Pin Number

Table 3.4 SE5901 Pin Assignment for DB9 to RS-232/RS-422/RS-485 Connector

<table>
<thead>
<tr>
<th>Pin#</th>
<th>RS-232 Full Duplex</th>
<th>RS-422/4-Wire RS-485 Full Duplex</th>
<th>2-Wire RS-485 Half Duplex</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DCD</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>2</td>
<td>RxD</td>
<td>TXD+</td>
<td>N/A</td>
</tr>
<tr>
<td>3</td>
<td>TxD</td>
<td>RXD+</td>
<td>Data+</td>
</tr>
<tr>
<td>4</td>
<td>DTR</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>5</td>
<td>SG (Signal Ground)</td>
<td>SG (Signal Ground)</td>
<td>SG (Signal Ground)</td>
</tr>
<tr>
<td>6</td>
<td>DSR</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>7</td>
<td>RTS</td>
<td>RXD-</td>
<td>Data-</td>
</tr>
<tr>
<td>8</td>
<td>CTS</td>
<td>TXD-</td>
<td>N/A</td>
</tr>
<tr>
<td>9</td>
<td>RI</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

1 x 5-pin (Male Terminal Block) for RS-232/RS-422/RS485 Connector

![TB5 Pin Number](image)

Figure 3.2 TB5 Pin Number

Table 3.5 SE5901 Pin Assignment for TB5 to RS-232/RS-422/RS-485 Connector

<table>
<thead>
<tr>
<th>Pin#</th>
<th>RS-232 Full Duplex</th>
<th>RS-422/4-Wire RS-485 Full Duplex</th>
<th>2-Wire RS-485 Half Duplex</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RxD</td>
<td>T+</td>
<td>NC</td>
</tr>
<tr>
<td>2</td>
<td>CTS</td>
<td>T-</td>
<td>NC</td>
</tr>
<tr>
<td>3</td>
<td>TxD</td>
<td>R+</td>
<td>Data+</td>
</tr>
<tr>
<td>4</td>
<td>RTS</td>
<td>R-</td>
<td>Data-</td>
</tr>
<tr>
<td>5</td>
<td>SG (Signal Ground)</td>
<td>SG (Signal Ground)</td>
<td>SG (Signal Ground)</td>
</tr>
</tbody>
</table>
3.5.2 **SE5904D Pin Assignments**

DB9 to RS-232/RS-485/RS-422 connectors

![Figure 3.3 DB9 Pin Number](image)

Table 3.6 MB5904D Pin Assignment for DB9 to RS-232/RS422/RS-485 Connectors

<table>
<thead>
<tr>
<th>Pin#</th>
<th>RS-232 Full Duplex</th>
<th>RS-422 Full Duplex</th>
<th>RS-485 Half Duplex</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DCD</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>2</td>
<td>RxD</td>
<td>TxD+</td>
<td>Data+</td>
</tr>
<tr>
<td>3</td>
<td>TxD</td>
<td>RxD+</td>
<td>N/A</td>
</tr>
<tr>
<td>4</td>
<td>DTR</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>5</td>
<td>SG (Signal Ground)</td>
<td>SG (Signal Ground)</td>
<td>SG (Signal Ground)</td>
</tr>
<tr>
<td>6</td>
<td>DSR</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>7</td>
<td>RTS</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>8</td>
<td>CTS</td>
<td>TxD-</td>
<td>Data-</td>
</tr>
<tr>
<td>9</td>
<td>RI</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

5-Pin Terminal Block to RS-485/RS-422 connectors

![Figure 3.4 Terminal Block (TB-5) Pin Number](image)

Table 3.7 MB5904D Pin Assignment for 5-Pin Terminal Block to RS-232/RS-422/RS-485 Connectors

<table>
<thead>
<tr>
<th>Pin#</th>
<th>RS-232</th>
<th>RS-422 4-Wire RS-485</th>
<th>2-W RS-485</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RxD</td>
<td>TxD+</td>
<td>Data+</td>
</tr>
<tr>
<td>2</td>
<td>CTS</td>
<td>TxD-</td>
<td>Data-</td>
</tr>
<tr>
<td>3</td>
<td>TxD</td>
<td>RxD+</td>
<td>N/A</td>
</tr>
<tr>
<td>4</td>
<td>RTS</td>
<td>RxD-</td>
<td>N/A</td>
</tr>
<tr>
<td>5</td>
<td>SG (Signal Ground)</td>
<td>SG (Signal Ground)</td>
<td>SG (Signal Ground)</td>
</tr>
</tbody>
</table>
3.5.3  
**SE5901B Pin Assignments**

**DB9 to RS-232/RS-485/RS-422 connectors**

![DB9 Pin Assignments](image)

**Figure 3.5 DB9 Pin Number**

Table 3.8 SE5901B Pin Assignment for DB9 to RS-232/RS-485 Connector

<table>
<thead>
<tr>
<th>Pin#</th>
<th>RS-232 Full Duplex</th>
<th>RS-485 Half Duplex</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DCD</td>
<td>N/A</td>
</tr>
<tr>
<td>2</td>
<td>RxD</td>
<td>N/A</td>
</tr>
<tr>
<td>3</td>
<td>TxD</td>
<td>Data+</td>
</tr>
<tr>
<td>4</td>
<td>DTR</td>
<td>N/A</td>
</tr>
<tr>
<td>5</td>
<td>SG (Signal Ground)</td>
<td>SG (Signal Ground)</td>
</tr>
<tr>
<td>6</td>
<td>DSR</td>
<td>N/A</td>
</tr>
<tr>
<td>7</td>
<td>RTS</td>
<td>Data-</td>
</tr>
<tr>
<td>8</td>
<td>CTS</td>
<td>N/A</td>
</tr>
<tr>
<td>9</td>
<td>RI</td>
<td>N/A</td>
</tr>
</tbody>
</table>

2 x 7-pin Male Terminal Block for RS-232/485(COM 1), RS-232(COM 2) Relay and DI

![2 x 7-pin Male Terminal Block](image)

**Figure 3.6 2 x 7-pin Male Terminal Block**

Table 3.9 SE5901B 2 x 7-pin Male TB for RS-232/485(COM 1), RS-232(COM 2) Relay and DI pin-assignment

<table>
<thead>
<tr>
<th>Pin#</th>
<th>DI and Relay</th>
<th>COM1 (RS-232)</th>
<th>COM1 (RS-485)</th>
<th>COM2 (RS-232)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DI1</td>
<td>Dedicated for DI/DO</td>
<td>Dedicated for DI/DO</td>
<td>Dedicated for DI/DO</td>
</tr>
<tr>
<td>2</td>
<td>DI2</td>
<td>Dedicated for DI/DO</td>
<td>Dedicated for DI/DO</td>
<td>Dedicated for DI/DO</td>
</tr>
<tr>
<td>3</td>
<td>Relay 1 -</td>
<td>Dedicated for DI/DO</td>
<td>Dedicated for DI/DO</td>
<td>Dedicated for DI/DO</td>
</tr>
<tr>
<td>4</td>
<td>Relay 1+</td>
<td>Dedicated for DI/DO</td>
<td>Dedicated for DI/DO</td>
<td>Dedicated for DI/DO</td>
</tr>
<tr>
<td>5</td>
<td>Relay 2 -</td>
<td>Dedicated for DI/DO</td>
<td>Dedicated for DI/DO</td>
<td>Dedicated for DI/DO</td>
</tr>
<tr>
<td>6</td>
<td>Relay 2+</td>
<td>Dedicated for DI/DO</td>
<td>Dedicated for DI/DO</td>
<td>Dedicated for DI/DO</td>
</tr>
<tr>
<td>7</td>
<td>Dedicated for COM</td>
<td>SG (Signal Ground)</td>
<td>SG (Signal Ground)</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>Dedicated for COM</td>
<td>Rx</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>Dedicated for COM</td>
<td>CTS</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td>Dedicated for COM</td>
<td>Tx</td>
<td>Data+</td>
<td>-</td>
</tr>
<tr>
<td>11</td>
<td>Dedicated for COM</td>
<td>RTS</td>
<td>Data-</td>
<td>-</td>
</tr>
<tr>
<td>12</td>
<td>Dedicated for COM</td>
<td>-</td>
<td>-</td>
<td>SG (Signal Ground)</td>
</tr>
<tr>
<td>13</td>
<td>Dedicated for COM</td>
<td>-</td>
<td>-</td>
<td>Rx</td>
</tr>
<tr>
<td>14</td>
<td>Dedicated for COM</td>
<td>-</td>
<td>-</td>
<td>Tx</td>
</tr>
</tbody>
</table>
3.5.4 SE5908A/SE5916A Pin Assignments

DB9 to RS-232/RS-485/RS-422 connectors

![DB9 Pin Diagram]

Table 3.10 SE5908A/16A Pin Assignment for DB9 to RS-232/RS422/RS-485 Connectors

<table>
<thead>
<tr>
<th>Pin#</th>
<th>RS-232</th>
<th>RS-422</th>
<th>RS-485</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>RxD</td>
<td>TxD+</td>
<td>Data+</td>
</tr>
<tr>
<td>3</td>
<td>TxD</td>
<td>RxD+</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>SG (Signal Ground)</td>
<td>SG (Signal Ground)</td>
<td>SG (Signal Ground)</td>
</tr>
<tr>
<td>6</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>RTS</td>
<td>RxD-</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>CTS</td>
<td>TxD-</td>
<td>Data-</td>
</tr>
<tr>
<td>9</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

5-Pin Terminal Block to RS-232/RS-485/RS-422 connectors

![Terminal Block Diagram]

Table 3.11 SE5908A/16A Pin Assignment for 5-Pin Terminal Block to RS-232/RS422/RS-485 Connectors

<table>
<thead>
<tr>
<th>Pin#</th>
<th>RS-232</th>
<th>RS-422 4-Wire RS-485</th>
<th>2-W RS-485</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RxD</td>
<td>TxD+</td>
<td>Data +</td>
</tr>
<tr>
<td>2</td>
<td>CTS</td>
<td>TxD-</td>
<td>Data -</td>
</tr>
<tr>
<td>3</td>
<td>TxD</td>
<td>RxD+</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>RTS</td>
<td>RxD-</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>SG (Signal Ground)</td>
<td>SG (Signal Ground)</td>
<td>SG (Signal Ground)</td>
</tr>
</tbody>
</table>
4 Software Specifications

The device node is the communication interface between user space and hardware device in Linux. Each chapter is divided into two parts:

1. **How to program these interfaces** – The main purpose is to provide the way to access device node with some sample code.
2. **How to test the interface** – The main purpose is to describe the way to use Linux internal or Atop supporting tools to test the interfaces.

4.1 COM Port Interface

SE59XX Series (Except SE5900A) are equipped with COM ports. Each COM port is registered as a TTY terminal interface with the kernel.

- Maximum baud rate: 921600
- Minimum baud rate: 300
- Serial interface supported: RS232 / RS485 / RS422

The sample program is in the software/atop_application/utils/atop_loopback folder:

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>rs232_loopback.c</td>
<td>Loopback test program for RS232 ports</td>
</tr>
<tr>
<td>rs422_loopback.c</td>
<td>Loopback test program for RS422 ports</td>
</tr>
<tr>
<td>rs485_loopback.c</td>
<td>Loopback test program for RS485 ports</td>
</tr>
</tbody>
</table>

4.1.1 Program COM port interface

The following tables list the device node of COM port for each EVM model.

<table>
<thead>
<tr>
<th>Device node</th>
<th>Major &amp; Minor number</th>
<th>Device Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ttyATOP0</td>
<td>266 0</td>
<td>Character</td>
<td>ATOP COM port 1</td>
</tr>
<tr>
<td>ttyATOP1</td>
<td>266 1</td>
<td>Character</td>
<td>ATOP COM port 2</td>
</tr>
<tr>
<td>ttyATOP2</td>
<td>266 2</td>
<td>Character</td>
<td>ATOP COM port 3</td>
</tr>
<tr>
<td>ttyATOP3</td>
<td>266 3</td>
<td>Character</td>
<td>ATOP COM port 4</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Device node</th>
<th>Ioctl command</th>
<th>Command Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ttyATOP0-3</td>
<td>0x9000</td>
<td>Configure SE59XX COM port as one of RS232 / RS485 / RS422</td>
</tr>
</tbody>
</table>
4.2 Network Interface

SE59XX Series are equipped with Network ports. The sample program in the folder software/atop_application/utils/atop_tcpserver describes how to use COM ports in combination with TCP server connections:

Table 4.5 Sample programs for TCP server connection to COM port communication

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>atop_tcp_server.c</td>
<td>A sample program to use TCP server connection and COM port to make data communication.</td>
</tr>
</tbody>
</table>

4.3 Other Interfaces

There are multiple other interfaces available on SE59XX platform, depending on the actual hardware in use. Some devices are equipped with 4G connectivity, others with Relays and Digital inputs and so on. ATOP’s convenient Software Development Kit is standardized for the whole family. We put at disposal simple programs that you can easily copy or emulate to make the best use of all interfaces.

All sample programs are in /atop_application/utils/atop_sdk folder:

4.3.1 Buzzer

There is one Buzzer in each SE59XX device. The sample program is available in the software/atop_application/utils/atop_sdk folder:

Table 4.6 Sample program for Buzzer

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>buzzer.c</td>
<td>A sample program to use the device’s Buzzer.</td>
</tr>
</tbody>
</table>
4.3.2  **Digital Inputs**
There are 2 Digital inputs on SE5901B-I/O. The sample program is available in the software/atop_application/utils/atop_sdk folder:

Table 4.7 Sample program for Digital Input

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>di_test.c</td>
<td>A sample program to use the device’s Digital Inputs.</td>
</tr>
</tbody>
</table>

4.3.3  **Digital Outputs**
There are 2 Digital Outputs on SE5901B-I/O. The sample program is available in the software/atop_application/utils/atop_sdk folder:

Table 4.8 Sample program for Digital Output

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>do_test.c</td>
<td>A sample program to use the device’s Digital Outputs.</td>
</tr>
</tbody>
</table>

4.3.4  **Relay Outputs**
There are Relay outputs on SE5904D, SE5908, SE5916, SE5900A, SE5908A and SE5916A. The sample program is available in the software/atop_application/utils/atop_sdk folder:

Table 4.9 Sample program for Relay Output

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>relay.c</td>
<td>A sample program to use the device’s Relay Outputs.</td>
</tr>
</tbody>
</table>

4.3.5  **LCM (SE5908 / SE5916 only)**
There is an LCM in SE5908 and SE5916. The sample program is available in the software/atop_application/utils/atop_sdk folder:

Table 4.10 Sample program for LCM

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>lcm_test.c</td>
<td>A sample program to use the device’s LCM.</td>
</tr>
</tbody>
</table>

4.3.6  **Reset Button**
All SE59XX hardware platforms have a reset button. The sample program is available in the software/atop_application/utils/atop_sdk folder:

Table 4.11 Sample program for Reset Button

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>button.c</td>
<td>A sample program to use the device’s reset button.</td>
</tr>
</tbody>
</table>
4.3.7 **Hardware Watchdog Timer**
There is a hardware watchdog IC on each CPU board. If this IC is not reset within 1.6 seconds, then the system will reboot. This implementation allows the hardware to autonomously understand if the system is crashing, for whatever reason. During a System crash, the OS won't reset the IC within the deadline and therefore the system will automatically reboot. All SE59XX hardware platforms do have an integrated hardware watchdog timer. The sample program is available in the software/atop_application/utils/atop_sdk folder:

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>hwd.c</td>
<td>A sample program to use the device's Hardware Watchdog timer.</td>
</tr>
</tbody>
</table>

### Table 4.12 Sample program for WDT

4.3.8 **LEDs**
Different devices in SE59XX family have different LEDs based on the number of ports. But all devices are equipped with a RUN/Fault LED. The sample program is available in the software/atop_application/utils/atop_sdk folder:

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>alarmLed.c</td>
<td>A sample program to use the device's Alarm (RED) LED</td>
</tr>
<tr>
<td>runLed.c</td>
<td>A sample program to use the device's Run (GREEN) LED</td>
</tr>
</tbody>
</table>

### Table 4.13 Sample program for LEDs

4.3.9 **3G/4G Cellular (SE5901B only)**
The sample program is available in the software/atop_application/utils/atop_sdk folder:

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>atop_4G_apn.c</td>
<td>A sample program to set the cellular Access Point</td>
</tr>
<tr>
<td>atop_4G_connect.c</td>
<td>A sample program to connect to 3G/4G</td>
</tr>
<tr>
<td>atop_4G_DialOnBoot.c</td>
<td>A sample program to set the device to dial on boot</td>
</tr>
<tr>
<td>atop_4G_PinDisable.c</td>
<td>A sample program to disable the SIM PIN</td>
</tr>
<tr>
<td>atop_4G_PinEnable.c</td>
<td>A sample program to enable the SIM PIN</td>
</tr>
<tr>
<td>atop_4G_reconnect.c</td>
<td>A sample program to reconnect to the cellular network</td>
</tr>
<tr>
<td>atop_4G_reset.c</td>
<td>A sample program to reset the cellular module</td>
</tr>
</tbody>
</table>

### Table 4.14 Sample program for Cellular functions

4.3.10 **RTC Interface**
There is one RTC clock via I2C interface, and it supports time unit to second/minute/hour/day/month/year up to year 2099.
5 Testing interfaces

ATOP provides some simple text programs. Please follow the below instructions to test the interfaces when it's needed.

5.1 Test COM port interface – transmit and receive

RS232 / RS422 / RS485 loopback test:

Execute rs232_loopback under the kernel shell. Be sure that you have connect the testing COM ports connected. Be sure to make TXD & RXD pins connected.

```
rs232_loopback
rs422_loopback
rs485_loopback
```

The baud rate is set at 115200

5.1.1 Test COM port interface by using atop_tcp_server

5.1.1.1 Test Method

The setup of the testing is shown as Figure 5.1.

![Figure 5.1 COM1 loopback test connection](image)

5.1.1.2 Test Execution

1) Execute the command "atop_tcp_server" as next line to test RS232 with baud rate 115200.
   
   ```
   atop_tcp_server RS232 115200 &
   ```

2) Type "ps -ef" from super terminal program to check if atop_tcp_server is executed as Figure 5.2
Figure 5.2 Process execution on SE5904D, example

3) Connect loopback for COM1 and execute TCPtest from MS-Windows as Figure 5.3

![TCPtest Interface](image)

Figure 5.3 Setup TCPtest.exe for COM port loopback test

4) Select the TCP_Server mode and input IP address and TCP port number for COM1.
5) Click "Connect" to make TCP connections. The data keyed in "Send" box will be sent through the COM port. "Send Loop" is used to send continuously every certain period of time.
6) Click "Send One" to start the data transmission from PC to COM port. The data received from loopback link will be shown on the lower part "Receive" box of the Window as Figure 3-4.
7) You should be able to see "Hello" as hexadecimal display of each character "48 65 6C 6C 6F 0D 0A" shown on "Receive" box.
The default mapping table between TCP port number and COM port number:

Table 5.1 TCP-port to COM-port mapping

<table>
<thead>
<tr>
<th>COM port</th>
<th>TCP port</th>
</tr>
</thead>
<tbody>
<tr>
<td>COM 1</td>
<td>4660</td>
</tr>
<tr>
<td>COM 2</td>
<td>4661</td>
</tr>
<tr>
<td>COM 3</td>
<td>4662</td>
</tr>
<tr>
<td>COM 4</td>
<td>4663</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>COM 16</td>
<td>4660 + (16-1)</td>
</tr>
</tbody>
</table>

5.2 Test Buzzer interface

Upload the test file “buzzer” from ./software/atop_application folder into /jffs2 and execute the following command on the kernel shell:

```
/buzzer <on/off>
```

- on: enable
- off: disable

```
/buzzer on
```

You should hear the buzzer
5.3 **Test Digital Input**

Upload the test file "di_test" from ./software/atop_application folder into /jffs2 and execute the following command on the kernel shell:

```
./di_test
```

You can see the message print DI0/1 value.

---

5.4 **Test Digital Output**

Upload the test file "do_test" from ./software/atop_application folder into /jffs2 and execute the following command on the kernel shell:

```
./do_test
```

You can use multimeter to check the DO0/1 turn on 5 sec then turn off.

---

5.5 **Test Hardware Relay Output**

Use test tool "relay" to test HW relay device.

```
./relay
```

You can use multimeter to check the relay turn on then turn off after 10 sec.

---

5.6 **Test Hardware Button**

Use test tool "button" to get "press" then "release" event.

```
./button
```

---

5.7 **Test Hardware Watchdog Interface (WDT)**

Upload test file "hwd" from ./software/atop_application folder into /jffs2 and execute the following command on the kernel shell:

```
./hwd
```

If watchdog is not cleared or disabled in the source code, then system will restart automatically after 1.6 sec.
5.8 **Test device LED**

Upload test file "runLed" from ./software/atop_application folder to /jffs2 and execute the following command on the kernel shell:

```
/runLed <on/off>
```

- on: enable
- off: disable

You should see the RUN Led turn on or off.

Use test tool "alarmLed" to test HW alarm LED.

```
/alarmLed on
/alarmLed off
```

You should see the ALARM(Red) Led turn on or off.

5.9 **Test RTC interface**

Upload test file “rtc” from ./software/atop_application folder to /jffs2 and execute the following command on the kernel shell:

Set link file:

```
ln -s rtc get_rtc
ln -s rtc set_rtc
ln -s rtc rtc2system
ln -s rtc system2rtc
```

5.9.1 **Setup RTC time:**

Execute the following command on the kernel shell:

```
/setrtc 2017/02/15-18:00:00
```

It will process both commands "date -s 2017-02-15 18:00:00" and "hwclock -w -f /dev/rtc1".

5.9.2 **Read RTC time:**

Execute the following command on the kernel shell:

```
/get_rtc
```

It will process command "hwclock -r -f /dev/rtc1".

The console will display the current RTC time such as "Wed Feb 1 14:11:50 2017"

5.9.3 **RTC2system**

Execute the following command on the kernel shell:
It will process command "hwclock –s –f /dev/rtc1". rtc2system: set system time from hardware clock.

5.9.4 system2RTC
Execute the following command on the kernel shell:

```
/system2rtc
```

It will process command "hwclock –w –f /dev/rtc1". system2rtc: set hardware clock from system time.

In order to make sure the clock was set correctly, turn off the power and restart the system. After startup is completed, check the RTC time.

5.10 Using NOR Flash – JFFS2

There is a NOR flash on each device. 16MB of it is reserved for user applications mounted on /jffs2 file system. This will be mounted automatically on system start-up. The user can put all application programs and the related data into /jffs2.

All data in the /jffs2 will be kept when system is shut down.

5.11 MQTT

You can use http://test.mosquitto.org/ MQTT broker(server) for testing.

**Subscriber and Publisher example:**

```
mosquitto_sub -h test.mosquitto.org -t "atop" -v &
mosquitto_pub -h test.mosquitto.org -t "atop" -m "Hello World"
```

**MQTT with example (You can download test certificates from test.mosquitto.org):**

```
mosquitto_sub -h test.mosquitto.org -p 8883 -t "atop" --cafile /jffs2/mosquitto.org.crt &
mosquitto_pub -h test.mosquitto.org -p 8883 -t "atop" --cafile ./mosquitto.org.crt -d -m "test"
```

**MQTT with username and password example:**

```
mosquitto_sub -h 192.168.4.238 -u atop -P 123456 -d -t atop &
mosquitto_pub -h 192.168.4.238 -u atop -P 123456 -d -t atop -m "test123"
```

5.12 Firmware upgrade

Use test tool "frmwr-upgrd" to upgrade kernel & rootfs.

`./frmwr-upgrd xxx.dld`

note: The upgrade program only support dld file format.
6 Software API Reference

Software API is to be referred by the software application to configure system environment, include user name, password and network setting. The user can configure and then restart the system to make the new environment effective.

The Application needs to refer to libatopsdk.so and include atop_libsdk.h during compiling time.

6.1 Network

These APIs are used to set Network parameters of the Ethernet interfaces.

6.1.1 void AtopSDKSetNetIP(int eth, char *ip)
Description: Use this function set the network interface ethX IP address or set interface to DHCP. If, for example, you'd like to set eth0 to DHCP set the ip to “DHCP”, if want to set static IP address the ip can be “192.168.0.1”.
Return Value: None

6.1.2 void AtopSDKSetNetMask(int eth, char *mask)
Description: Use this function set the network interface ethX netmask address. If want to set netmask on eth0, eth should be 0 and mask can be “255.255.255.0”.
Return Value: None

6.1.3 void AtopSDKSetNetGateway(int eth, char *gateway)
Description: Use this function set the network interface ethX gateway address. If want to set gateway on eth0, eth should be 0 and mask can be “192.168.0.254”.
Return Value: None

6.1.4 void AtopSDKSetNetDefGateway(int eth)
Description: Use this function set the default gateway interface. If want eth1 gateway be the default gateway, eth set to 1.
Return Value: None
6.2 User Configuration

These APIs are used to set User Access credentials.

6.2.1 void AtopSDKSetUserName(char *name)
Description: Use this function change administrator user name, the length limitation is 8 characters. If want to change user name to root set the parameter name to "root".
Return Value: None

6.2.2 void AtopSDKSetUserPassword(char *password)
Description: User this function change administrator login password, the length limitation is 8 characters. If want to change password to root set the parameter password to "root".
Return Value: None
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