

# TIP867-SW-72

## LynxOS Device Driver

8 Channel RS485 Interface

Version 1.0.x

## User Manual

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**TIP867-SW-72**

LynxOS Device Driver

8 Channel RS485 Interface

Supported Modules:

TIP867-10

TIP867-20

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# 1 Introduction

## 1.1 Device Driver

The TIP867-SW-72 LynxOS device driver is a full-duplex tty device driver, which allows the operation of a TIP867 serial IPAC module on LynxOS operating systems.

Because the TIP867 device driver is stacked on the TEWS TECHNOLOGIES IPAC Carrier Driver, it is necessary to install also the IPAC Carrier Driver. Please refer to the IPAC Carrier Driver user manual for further information.

The TIP867-SW-72 device driver is based on the standard LynxOS terminal manager. Due to this way of implementation the driver interface and function is absolute compatible to the standard LynxOS terminal driver.

All standard utility programs for configuration and maintaining terminal interfaces could be used in the same manner. There is only one exception; the TIP867-SW-72 can't be used as console driver.

The TIP867-SW-72 device driver supports the following features:

- Asynchronous communication with baud rates up to 115200 baud
- Static and dynamic driver installation support.
- TEWS TECHNOLOGIES IPAC Carrier Driver support.

The TIP867-SW-72 device driver supports the modules listed below:

TIP867-xx      8 Channel RS485 Interface      IndustryPack®

**In this document all supported modules and devices will be called TIP867. Specials for certain devices will be advised.**

To get more information about the features and use of TIP867 devices it is recommended to read the manuals listed below.

TIP867 User manual  
TIP867 Engineering Manual

## 1.2 IPAC Carrier Driver

IndustryPack (IPAC) carrier boards have different implementations of the system to IndustryPack bus bridge logic, different implementations of interrupt and error handling and so on. Also the different byte ordering (big-endian versus little-endian) of CPU boards will cause problems on accessing the IndustryPack I/O and memory spaces.

To simplify the implementation of IPAC device drivers which work with any supported carrier board, TEWS TECHNOLOGIES has designed a so called Carrier Driver that hides all differences of different carrier boards under a well defined interface.

The TEWS TECHNOLOGIES IPAC Carrier Driver CARRIER-SW-72 is part of this TIP867-SW-72 distribution. It is located in directory CARRIER-SW-72 on the corresponding distribution media.

This IPAC Device Driver requires a properly installed IPAC Carrier Driver. Due to the design of the Carrier Driver, it is sufficient to install the IPAC Carrier Driver once, even if multiple IPAC Device Drivers are used.

Please refer to the CARRIER-SW-72 User Manual for a detailed description how to install and setup the CARRIER-SW-72 device driver, and for a description of the TEWS TECHNOLOGIES IPAC Carrier Driver concept.

## 2 Installation

Following files are located on the distribution media:

Directory path 'TIP867-SW-72':

TIP867-SW-72-SRC.tar.gz	GZIP compressed archive with driver source code
TIP867-SW-72-1.0.1.pdf	PDF copy of this manual
ChangeLog.txt	Release history
Release.txt	Release information

For installation the files have to be copied to the desired target directory.

The GZIP compressed archive TIP867-SW-72-SRC.tar.gz contains the following files and directories:

Directory path 'tip867':

tip867.c	TIP867 device driver source
tip867def.h	TIP867 driver include file
tip867_info.c	Device information definition
tip867_info.h	Device information definition header
tip867.cfg	Driver configuration file include
tip867.import	Linker import file
Makefile	Device driver make file

In order to perform an installation, extract all files of the archive TIP867-SW-72-SRC.tar.gz to the desired target directory. The command 'tar -xzf TIP867-SW-72-SRC.tar.gz' will extract the files into the local directory.

1. Create a new directory in the system drivers directory path /sys/drivers.xxx, where xxx represents the BSP that supports the target hardware.

For example: /sys/drivers.pp\_drm/tip867 or /sys/drivers.cpci\_x86/tip867

2. Copy the following files to this directory:

- tip867.c
- tip867.import
- Makefile

3. Copy tip867\_info.c to /sys/devices.xxx/ or /sys/devices if /sys/devices.xxx does not exist (xxx represents the BSP).

4. Copy tip867\_info.h to /sys/dheaders/

5. Copy tip867.cfg to /sys/cfg.xxx/, where xxx represents the BSP for the target platform

For example: /sys/cfg.ppc or /sys/cfg.x86 ....

**Before building a new device driver, the TEWS TECHNOLOGIES IPAC carrier driver must be installed properly, because this driver includes the header file *ipac\_carrier.h*, which is part of the IPAC carrier driver distribution. Please refer to the IPAC carrier driver user manual in the directory path *CARRIER-SW-72* on the separate distribution media.**

## 2.1 Device Driver Installation

The two methods of driver installation are as follows:

- Static Installation
- Dynamic Installation

**Both installation methods require the TEWS TECHNOLOGIES IPAC Carrier Driver. Please refer to the IPAC Carrier Driver User Manual for detailed information.**

### 2.1.1 Static Installation

With this method, the driver object code is linked with the kernel routines and is installed during system start-up.

#### 2.1.1.1 Build the driver object

1. Change to the directory `/sys/drivers.xxx/tip867`, where `xxx` represents the BSP that supports the target hardware.
2. To update the library `/sys/lib/libdrivers.a` enter:

```
make install
```

#### 2.1.1.2 Create Device Information Declaration

1. Change to the directory `/sys/devices.xxx/` or `/sys/devices` if `/sys/devices.xxx` does not exist (`xxx` represents the BSP).

2. Add the following dependencies to the Makefile

```
DEVICE_FILES_all = ... tip867_info.x
```

And at the end of the Makefile

```
tip867_info.o:$(DHEADERS)/tip867_info.h
```

3. To update the library `/sys/lib/libdevices.a` enter:

```
make install
```

#### 2.1.1.3 Modify the Device and Driver Configuration File

In order to insert the driver object code into the kernel image, an appropriate entry in file `CONFIG.TBL` must be created.

1. Change to the directory `/sys/lynx.os/` respective `/sys/bsp.xxx`, where `xxx` represents the BSP that supports the target hardware.
2. Create an entry at the end of the file `CONFIG.TBL`

Insert the following entry at the end of this file. Be sure that the necessary TEWS TECHNOLOGIES IPAC carrier driver is included **before** this entry.

```
I:tip867.cfg
```

---

#### 2.1.1.4 Rebuild the Kernel

1. Change to the directory `/sys/lynx.os/ (/sys/bsp.xxx)`
2. Enter the following command to rebuild the kernel:

```
make install
```

3. Reboot the newly created operating system by the following command (not necessary for KDIs):

```
reboot -aN
```

The N flag instructs init to run `mknod` and create all the nodes mentioned in the new `nodetab`.

After reboot you should find the following new devices (depends on the device configuration):  
`/dev/tip867_0, [/dev/tip867_15, ...]`



## 2.1.2 Dynamic Installation

This method allows you to install the driver after the operating system is booted. The driver object code is attached to the end of the kernel image and the operating system dynamically adds this driver to its internal structures. The driver can also be removed dynamically.

### 2.1.2.1 Build the driver object

1. Change to the directory `/sys/drivers.xxx/tip867`, where `xxx` represents the BSP that supports the target hardware.
2. To make the dynamic link-able driver enter :

```
make dldd
```

### 2.1.2.2 Create Device Information Declaration

1. Change to the directory `/sys/drivers.xxx/tip867`, where `xxx` represents the BSP that supports the target hardware.
2. To create a device definition file for the major device (this works only on native system)

```
make t867info
```

3. To install the driver enter:

```
drinstall -c tip867.obj
```

If successful, `drinstall` returns a unique `<driver-ID>`

4. To install the major device enter:

```
devinstall -c -d <driver-ID> t867info
```

The `<driver-ID>` is returned by the `drinstall` command

5. To create nodes for the devices enter:

```
mknod /dev/tip867_0 c <major_no> 0
```

```
mknod /dev/tip867_1 c <major_no> 1
```

```
mknod /dev/tip867_2 c <major_no> 2
```

```
...
```

The `<major_no>` is returned by the `devinstall` command.

If all steps are successful completed the TIP867 is ready to use.

### 2.1.2.3 Uninstall dynamic loaded driver

To uninstall the TIP867 device enter the following commands:

```
devinstall -u -c <device-ID>
```

```
drinstall -u <driver-ID>
```

## 2.1.3 Device Information Definition File

The device information definition contains information necessary to install the TIP867 major device.

The implementation of the device information definition is done by a C structure which is defined in the header file `tip867_info.h`.

This structure contains following parameters:

`sg`

This structure contains initial tty parameter like baud rate special characters and so on. Refer also to the tty man pages.

The settings above will be used as default settings for all minor devices (serial channels) in common.

A TIP867 major device can support an “unlimited” number of minor devices respective TIP867 IPAC modules. The order in which the TIP867 channels are assigned to the device nodes in the `/dev` directory depends on the search order of the TEWS TECHNOLOGIES IPAC carrier driver. Please refer to the IPAC Carrier driver manual for further information.

If only one TIP867 is used the device node `/dev/tip867_0` corresponds to the serial channel 1, node `/dev/tip867_1` to serial channel 2 and so on.

```
T867_INFO t867info = {
    {
        B9600, B9600,          /* input and output speed      */
        'H' - '@',           /* erase char                   */
        -1,                   /* 2nd erase char              */
        'U' - '@',           /* kill char                    */
        RAW,                  /* mode                         */
        'C' - '@',           /* interrupt character          */
        '\\',                  /* quit char                    */
        'Q' - '@',           /* start char                   */
        'S' - '@',           /* stop char                    */
        'D' - '@',           /* EOF                           */
        -1,                   /* brk                           */
        0,                     /* local mode word              */
        'Z' - '@',           /* process stop                 */
        'Y' - '@',           /* delayed stop                 */
        'R' - '@',           /* reprint line                  */
        'O' - '@',           /* flush output                 */
        'W' - '@',           /* word erase                    */
        'V' - '@',           /* literal next char            */
    }
};
```

## 2.1.4 Configuration File: CONFIG.TBL

The device and driver configuration file CONFIG.TBL contain entries for device drivers and its major and minor device declarations. Each time the system is rebuild, the config utility read this file and produces a new set of driver and device configuration tables and a corresponding nodetab.

To install the TIP867 driver and devices into the LynxOS system, the configuration include file tip867.cfg must be included in the CONFIG.TBL (see also 2.1.1.3).

The file tip867.cfg on the distribution disk contains the driver entry (C:tip867:\...) and a major device entry (D:TIP867:t867info::) with 16 minor device entries (N: tip867\_0:0 ... N:tip867\_15:15).

If the driver should support more than 16 minor devices (serial channels) because more than 2 TIP867 are plugged, additional minor device entries must be added. To create the device node /dev/tip867\_16 the line N:tip867\_16:16 must be added at the end of the file tip867.cfg. For the next node a minor device entry with 17 must be added and so on.

NOTE. The name of the device information declaration (info-block-name) must match to an existing C structure in the file tip867\_info.c.

This example shows a driver entry with a major device and 16 minor devices:

```
#   Format :
#   C:driver-name:open:close:read:write:select:control:install:uninstall
#   D:device-name:info-block-name:raw-partner-name
#   N:node-name:minor-dev

C:tip867:\
    :t867open:t867close:t867read:t867write:\
    :t867select:t867ioctl:t867install:t867uninstall
D:TIP867:t867info::
N:tip867_0:0
N:tip867_1:1
...
N:tip867_15:15
```

The configuration above creates the following nodes in the /dev directory.

```
/dev/tip867_0
/dev/tip867_1
...
/dev/tip867_15
```

---

## **3 Device Driver Programming**

LynxOS system calls are all available directly to any C program. They are implemented as ordinary function calls to "glue" routines in the system library, which trap to the OS code.

Note that many system calls use data structures, which should be obtained in a program from appropriate header files. Necessary header files are listed with the system call synopsis.

Because the TIP867-SW-72 device driver is based on the standard LynxOS terminal manager, the driver interface and functions are absolutely compatible to the standard LynxOS terminal driver and support System V and POSIX terminal programming.

## 4 Diagnostic

If your installed IPAC port driver (i.e. tip867) doesn't find any devices although the IPAC is properly plugged on a carrier board, it is interesting to know what is going on in the system.

Usually all TEWS TECHNOLOGIES device drivers announce significant events or errors via the device driver routine `kkprintf()`. To enable the debug output you must define the macro `DEBUG` in the device driver source files (e.g. `carrier_class.c`, `carrier_tews_pci.c`, `tip867.c`,...).

The following output appears at the LynxOS debug console if the Carrier and IPAC drivers start:

```
TEWS TECHNOLOGIES - IPAC Carrier Class Driver version 1.0.0 (2003-11-28)
TEWS TECHNOLOGIES - (Compact)PCI IPAC Carrier version 1.0.0 (2003-11-28)
TEWS_PCI : Probe new device (vendor=0x1498, device=0x30C8, #slots=4)
IPAC_CC : IPAC (Manuf-ID=B3, Model#=24) recognized @ slot=3 carrier=<TEWS TECHNOLOGIES -
(Compact)PCI IPAC Carrier>

TIP867 - 8 Channel Serial IP version 1.0.0 (2007-12-19)
TIP867 : Probe new TIP867 mounted on <TEWS TECHNOLOGIES - (Compact)PCI IPAC Carrier> at slot D
```

If you can't solve the problem on your own, please contact TEWS TECHNOLOGIES with a detailed description of the error condition, your system configuration and the debug outputs.