

How To Start Working with the MCG

Disclaimer

This document describes how to setup HW and SW to work with the MCG.

It contains recommendations and best practices. Those are not mandatory to be followed.

There is no consideration about protection or safety, e.g. ESD damage to MCG or with respect to power supply or distance to the transmitting Antennas.

It is expected that a trained expert capable of working in laboratory environment uses the MCG.

Overview

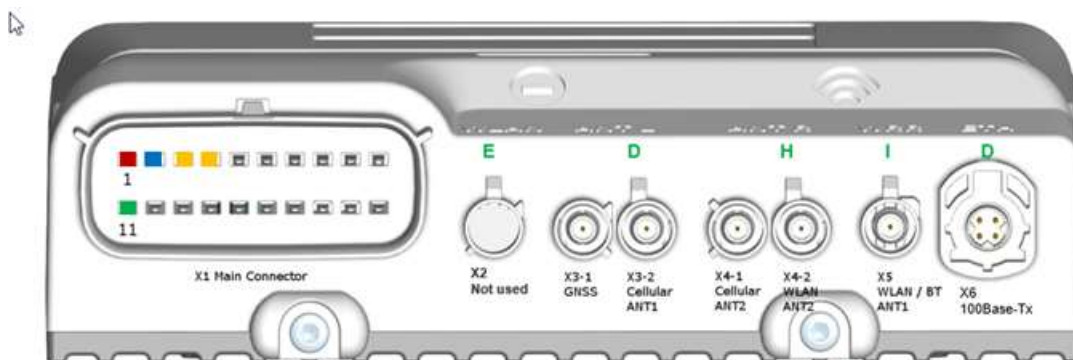
Please refer to the User Manual MCG-CEK06 for detailed description of the MCG.

E.g. HW block diagram and SW structure

For a first impression please refer to the summary provide on Liebherr Telematics & Gateways internet page here: <https://www.liebherr.com/telematics>

Electrical Connections

This is the Connector Face with its pin assignment:



- T30 (14V, Powersupply)
- T31 (GND)
- T15 (14V, Zündung zum Starten der UCM)
- RS232 Nr.1 (Tx, Rx)

Prerequisites

- Starter kit including the MCG device, the system cable for power supply and serial interface, HSD to RJ45 cable to connect Ethernet.
- Option: Instead of standard Ethernet, you can connect via automotive Ethernet (BroadR-Reach 100baseT1 is located on connector X1 pins 19 and 20).
- Power Supply for 12V or 24V capable of driving 3A@12V (Limit/Fuse 5A recommended)
- PC with Serial Port and Ethernet
- For modern PC without Serial a USB to Serial Adapter is recommended
- To allow PC still be connected to Internet/Company LAN a second Ethernet Adapter can be added via USB
- A Terminal program capable of serial and SSH connection (e.g. Putty)

Setup the HW

- Connect the cable harness to the UCM system connector.
- Connect the serial 1 connector to the PC Serial port
- Connect the power supply plugs to the power supply (12V or 24V)
- Connect the Ethernet cable to PC Ethernet

Appendix B shows example of the used cables, converters

Device Boot

The boot process consists of the following steps:

- Switch the power supply on
- The bootloader Uboot is loaded
- The Uboot starts the installed Linux system

The MCG LED indication (see Appendix A for Details)

- The Power LED (left LED0)
 - o During Boot-up
 - permanent red during Uboot
 - permanent orange when Linux starts
 - permanent green when Linux is started

Serial Terminal

Serial connection is useful during boot to see boot messages or interact with the Uboot.

To connect to the running Linux system an Ethernet connection via ssh is more convenient. (see below)

Connect PC serial interface to serial 1 connector

On the PC start a Serial Terminal, e.g. Putty, set to 115200 baud 8N1 and the correct COM port number.

Uboot prints its information to the Terminal

- o Start of Uboot messages is Uboot < *U-Boot 2014.10* >
- o Appendix C) shows example output

Options during Boot

The Uboot process can be halted by pressing any key in Terminal during its execution (before Linux starts). The [help] command shows the available Uboot commands. For in depth information please refer to [Uboot documentation here](#).

Use the command setenv to modify Uboot environment variables. To store the setting use saveenv. You can do this as well from the running Linux System with command fw_setenv.

Login to Linux OS via Ethernet and SSH

Ethernet Connection

Default Ethernet is 100baseTX on Connector X6

In case you cannot connect to Ethernet, the configuration might have been changed to route to BRR 100base T1, which is on system connector X1 pins 19 and 20. In this situation, either make use of 100baseT1 to 100baseTX converter or configure Ethernet to 100baseTX in Uboot environment with the following commands

```
LEG> setenv ethphy yes
```

```
LEG> saveenv; reset
```

The MCG is configured for an ip address of 192.168.3.48.

Configure your PCs network adapter accordingly

To a fixed address: e.g. to IP-Adress 192.168.3.50, netmask 255.255.255.0

SSH Login

Use an ssh client, e.g. Putty. Set the IP Adress of MCG and port 22.

On first connection, you might have to accept certificate



For login use user "root". There is no password set.

Appendix A) Troubleshooting

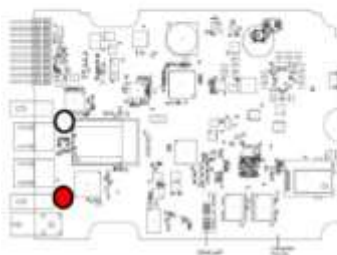
Blinking Codes of Power and Network LEDs



LED0

Grün: Technologie
4G – an
3G – 50/50 blinken
2G – Heartbeat
NO CONN – aus

Rot: Ping
> 1s oder Fail – an
300ms < ping < 1s : 50/50 blink
100ms < ping < 300ms: heartbeat
< 100ms: off



LED1

Grün: GPS FIX
GRÜN Dauer: 3D
Grün 50/50: 2D (keine Höhe)
Grün Heartbeat: 1D / nur Uhrzeit
Aus: —

Rot: Netzwerkmodus
Rot Dauer: keins von beiden
Rot Heartbeat: Roaming
Aus: Home

Character set for serial and ssh Terminals

You might need to set a fitting emulation and character set in the Terminal in order to work smoothly.

Appendix B) Setup example

The used HW, converters, cables are depicted here as an example. They are in no way a) endorsing certain brands, types or b) meaning this is the only way to bring up the MCG.

USB to Serial Adapter examples



USB to Ethernet Adapter examples



BRR to Ethernet (100baseT1 to 100baseTx) Adapter



Appendix C) Uboot Example Terminal Output

U-Boot 2014.10+fslc+g40588c4 (Jan 24 2018 - 13:15:21)

CPU: Freescale i.MX6Q rev1.5 at 792 MHz

Reset cause: POR

Board: MX6Q LEG UCM-C2 [3]

I2C: ready

DRAM: 1 GiB

setup_i2c: idx0 spd=100000 slave7f

setup_i2c: idx2 spd=100000 slave7f

PMIC: PFUZE100 ID=0x10

MMC: FSL_SDHC: 0, FSL_SDHC: 1

In: serial

Out: serial

Err: serial

Net: hw[3] ETH muxC2 eth eCLK AUTO@100 #1 imp FEC [PRIME]

Writing to redundant MMC(1)... done
Hit any key to stop autoboot: 0
Testing 3e000000 ... 40000000:
Tested 1 iteration(s) with 0 errors.
Saving Environment to MMC...
Writing to MMC(1)... done
switch to partitions #0, OK
mmc1(part 0) is current device
reading kernel.fit
8730976 bytes read in 540 ms (15.4 MiB/s)
Error writing the chip.
-> Authenticate ulmage/Fit image @ 20000000 ...

Authenticate image from DDR location 0x20000000...

Secure boot disabled

HAB Configuration: 0xf0, HAB State: 0x66
No HAB Events Found!

-> Authenticate ulmage/Fit successful

Loading kernel from FIT Image at 20000000 ...

Using 'conf@1' configuration

Trying 'kernel@1' kernel subimage

Description: Linux kernel

Type: Kernel Image

Compression: uncompressed

Data Start: 0x20000100

Data Size: 5332360 Bytes = 5.1 MiB

Architecture: ARM

OS: Linux

Load Address: 0x12000000

Entry Point: 0x12000000

Hash algo: sha256

Hash value: 2d877aa1c53c1e8f0913dba9f4788e63f0d984c7073544872b3c2b6cfec2640b

Verifying Hash Integrity ... sha256+ OK

Loading ramdisk from FIT Image at 20000000 ...

Using 'conf@1' configuration

Trying 'ramdisk@1' ramdisk subimage

Description: leg-initramfs-image

Type: RAMDisk Image

Compression: gzip compressed

Data Start: 0x2052c478

Data Size: 3295994 Bytes = 3.1 MiB

Architecture: ARM

OS: Linux

Load Address: unavailable

Entry Point: unavailable

Hash algo: sha256

Hash value: 3c0a6adffa044b7879c410eb5f130aad1c71aa7a9a73151197c9f2fbf630f414

Verifying Hash Integrity ... sha256+ OK

Loading fdt from FIT Image at 20000000 ...

Using 'conf@1' configuration

Trying 'fdt@imx6qleg-ucm-c.dtb' fdt subimage
Description: Flattened Device Tree blob
Type: Flat Device Tree
Compression: uncompressed
Data Start: 0x20515f98
Data Size: 45468 Bytes = 44.4 KiB
Architecture: ARM
Hash algo: sha256
Hash value: e89d22bbe1cc0ebaa7809b09ccd97d75a56567ccd88642e00b21764d49e010db
Verifying Hash Integrity ... sha256+ OK
Booting using the fdt blob at 0x20515f98
Loading Kernel Image ... OK
Loading Ramdisk to 4ec26000, end 4ef4aafa ... OK
Loading Device Tree to 4ec17000, end 4ec2519b ... OK
fdt fixup ethernet

Starting kernel ...

```
[ 0.192337] leg_rev v[3]
[ 0.192362] phy-type [3] [ETH]
[ 0.192370] external phy clock
[ 0.193161] imx6q-pinctrl 20e0000.iomuxc: no fsl,pins property in node /soc/aips-
bus@02000000/iomuxc@020e0000/usbh1/usbh1_alt_grp-1
[ 0.505061] PFUZE Init bc210c00
[ 0.505505] enabling COINCELL CHRG [0c:0]
[ 0.505941] enabling COINCELL CHRG [0c:0][ 0.578802] leg_rev v[3]
[ 0.587261] imx6q-pinctrl 20e0000.iomuxc: pin MX6Q_PAD_EIM_D22 already requested by
20e0000.iomuxc; cannot claim for 2184000.usb
[ 0.598864] imx6q-pinctrl 20e0000.iomuxc: pin-42 (2184000.usb) status -22
[ 0.605678] imx6q-pinctrl 20e0000.iomuxc: could not request pin 42 (MX6Q_PAD_EIM_D22) from
group usbotggrp-1 on device 20e0000.iomuxc
[ 0.617784] imx_usb 2184000.usb: Error applying setting, reverse things back
[ 0.795880] sdhci-esdhc-imx 219c000.usdhc: set ultra high speed state.
[ 0.954262] caam_jr 2101000.jr0: 20000b11: CCB: desc idx 11: AES: Mode error.
[ 0.961472] alg: aead: encryption failed on test 1 for rfc4106-gcm-aes-caam: ret=-536873745
[ 0.970115] caam_jr 2101000.jr0: 20000c11: CCB: desc idx 12: AES: Mode error.
[ 0.977374] alg: aead: encryption failed on test 1 for gcm-aes-caam: ret=-536874001
[ 1.010348] snvs-secvio 20cc000.caam-snvs: can't get snvs clock
Verification successful
[ 10.411321] leg_rev v[3]
```

Poky (Yocto Project Reference Distro) 2.0.1 imx6qleg-ucm-c /dev/ttymx4

imx6qleg-ucm-c login:

U-Boot 2014.10+fslc+g40588c4 (Jan 24 2018 - 13:15:21)

CPU: Freescale i.MX6Q rev1.5 at 792 MHz
Reset cause: POR
Board: MX6Q LEG UCM-C2 [3]
I2C: ready
DRAM: 1 GiB
setup_i2c: idx0 spd=100000 slave7f

setup_i2c: idx2 spd=100000 slave7f
PMIC: PFUZE100 ID=0x10
MMC: FSL_SDHC: 0, FSL_SDHC: 1
In: serial
Out: serial
Err: serial
Net: hw[3] ETH muxC2 eth eCLK AUTO@100 #1 imp FEC [PRIME]
Writing to MMC(1)... done
Hit any key to stop autoboot: 0
Testing 40000000 ... 42000000:
Tested 1 iteration(s) with 0 errors.
Saving Environment to MMC...
Writing to redundant MMC(1)... done
switch to partitions #0, OK
mmc1(part 0) is current device
reading kernel.fit
8730976 bytes read in 539 ms (15.4 MiB/s)
Error writing the chip.
-> Authenticate ulmage/Fit image @ 20000000 ...

Authenticate image from DDR location 0x20000000...

Secure boot disabled

HAB Configuration: 0xf0, HAB State: 0x66
No HAB Events Found!

-> Authenticate ulmage/Fit successful

Loading kernel from FIT Image at 20000000 ...

Using 'conf@1' configuration

Trying 'kernel@1' kernel subimage

Description: Linux kernel

Type: Kernel Image

Compression: uncompressed

Data Start: 0x20000100

Data Size: 5332360 Bytes = 5.1 MiB

Architecture: ARM

OS: Linux

Load Address: 0x12000000

Entry Point: 0x12000000

Hash algo: sha256

Hash value: 2d877aa1c53c1e8f0913dba9f4788e63f0d984c7073544872b3c2b6cfec2640b

Verifying Hash Integrity ... sha256+ OK

Loading ramdisk from FIT Image at 20000000 ...

Using 'conf@1' configuration

Trying 'ramdisk@1' ramdisk subimage

Description: leg-initramfs-image

Type: RAMDisk Image

Compression: gzip compressed

Data Start: 0x2052c478

Data Size: 3295994 Bytes = 3.1 MiB

Architecture: ARM

OS: Linux

Load Address: unavailable
Entry Point: unavailable
Hash algo: sha256
Hash value: 3c0a6adffa044b7879c410eb5f130aad1c71aa7a9a73151197c9f2fbf630f414
Verifying Hash Integrity ... sha256+ OK
Loading fdt from FIT Image at 20000000 ...
Using 'conf@1' configuration
Trying 'fdt@imx6qleg-ucm-c.dtb' fdt subimage
Description: Flattened Device Tree blob
Type: Flat Device Tree
Compression: uncompressed
Data Start: 0x20515f98
Data Size: 45468 Bytes = 44.4 KiB
Architecture: ARM
Hash algo: sha256
Hash value: e89d22bbe1cc0ebaa7809b09ccd97d75a56567ccd88642e00b21764d49e010db
Verifying Hash Integrity ... sha256+ OK
Booting using the fdt blob at 0x20515f98
Loading Kernel Image ... OK
Loading Ramdisk to 4ec26000, end 4ef4aafa ... OK
Loading Device Tree to 4ec17000, end 4ec2519b ... OK
fdt fixup ethernet

Starting kernel ...

```
[ 0.192380] leg_rev v[3]
[ 0.192406] phy-type [3] [ETH]
[ 0.192413] external phy clock
[ 0.193196] imx6q-pinctrl 20e0000.iomuxc: no fsl,pins property in node /soc/aips-
bus@02000000/iomuxc@020e0000/usbh1/usbh1_alt_grp-1
[ 0.505121] PFUZE Init bc210c00
[ 0.505565] enabling COINCELL CHRG [0c:0]
[ 0.506001] enabling COINCELL CHRG [0c:0][ 0.578736] leg_rev v[3]
[ 0.587133] imx6q-pinctrl 20e0000.iomuxc: pin MX6Q_PAD_EIM_D22 already requested by
20e0000.iomuxc; cannot claim for 2184000.usb
[ 0.598763] imx6q-pinctrl 20e0000.iomuxc: pin-42 (2184000.usb) status -22
[ 0.605602] imx6q-pinctrl 20e0000.iomuxc: could not request pin 42 (MX6Q_PAD_EIM_D22) from
group usbotggrp-1 on device 20e0000.iomuxc
[ 0.617736] imx_usb 2184000.usb: Error applying setting, reverse things back
[ 0.782652] sdhci-esdhc-imx 219c000.usdhc: set ultra high speed state.
[ 0.911097] caam_jr 2101000.jr0: 20000b11: CCB: desc idx 11: AES: Mode error.
[ 0.918384] alg: aead: encryption failed on test 1 for rfc4106-gcm-aes-caam: ret=-536873745
[ 0.927078] caam_jr 2101000.jr0: 20000c11: CCB: desc idx 12: AES: Mode error.
[ 0.934338] alg: aead: encryption failed on test 1 for gcm-aes-caam: ret=-536874001
[ 0.979767] snvs-secvio 20cc000.caam-snvs: can't get snvs clock
Verification successful
[ 11.851341] leg_rev v[3]
```

Poky (Yocto Project Reference Distro) 2.0.1 imx6qleg-ucm-c /dev/ttymx4

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CPU: Freescale i.MX6Q rev1.5 at 792 MHz
Reset cause: POR
Board: MX6Q LEG UCM-C2 [3]
I2C: ready
DRAM: 1 GiB
setup_i2c: idx0 spd=100000 slave7f
setup_i2c: idx2 spd=100000 slave7f
PMIC: PFUZE100 ID=0x10
MMC: FSL_SDHC: 0, FSL_SDHC: 1
In: serial
Out: serial
Err: serial
Net: hw[3] ETH muxC2 eth eCLK AUTO@100 #1 imp FEC [PRIME]
Writing to MMC(1)... done
Hit any key to stop autoboot: 0
Testing 42000000 ... 44000000:
Tested 1 iteration(s) with 0 errors.
Saving Environment to MMC...
Writing to redundant MMC(1)... done
switch to partitions #0, OK
mmc1(part 0) is current device
reading kernel.fit
8730976 bytes read in 539 ms (15.4 MiB/s)
Error writing the chip.
-> Authenticate ulmage/Fit image @ 20000000 ...

Authenticate image from DDR location 0x20000000...

Secure boot disabled

HAB Configuration: 0xf0, HAB State: 0x66
No HAB Events Found!

-> Authenticate ulmage/Fit successful
Loading kernel from FIT Image at 20000000 ...
Using 'conf@1' configuration
Trying 'kernel@1' kernel subimage
Description: Linux kernel
Type: Kernel Image
Compression: uncompressed
Data Start: 0x20000100
Data Size: 5332360 Bytes = 5.1 MiB
Architecture: ARM
OS: Linux
Load Address: 0x12000000
Entry Point: 0x12000000
Hash algo: sha256
Hash value: 2d877aa1c53c1e8f0913dba9f4788e63f0d984c7073544872b3c2b6cfec2640b
Verifying Hash Integrity ... sha256+ OK
Loading ramdisk from FIT Image at 20000000 ...
Using 'conf@1' configuration
Trying 'ramdisk@1' ramdisk subimage

Description: leg-initramfs-image
Type: RAMDisk Image
Compression: gzip compressed
Data Start: 0x2052c478
Data Size: 3295994 Bytes = 3.1 MiB
Architecture: ARM
OS: Linux
Load Address: unavailable
Entry Point: unavailable
Hash algo: sha256
Hash value: 3c0a6adffa044b7879c410eb5f130aad1c71aa7a9a73151197c9f2fbf630f414
Verifying Hash Integrity ... sha256+ OK
Loading fdt from FIT Image at 20000000 ...
Using 'conf@1' configuration
Trying 'fdt@imx6qleg-ucm-c.dtb' fdt subimage
Description: Flattened Device Tree blob
Type: Flat Device Tree
Compression: uncompressed
Data Start: 0x20515f98
Data Size: 45468 Bytes = 44.4 KiB
Architecture: ARM
Hash algo: sha256
Hash value: e89d22bbe1cc0ebaa7809b09ccd97d75a56567ccd88642e00b21764d49e010db
Verifying Hash Integrity ... sha256+ OK
Booting using the fdt blob at 0x20515f98
Loading Kernel Image ... OK
Loading Ramdisk to 4ec26000, end 4ef4aafa ... OK
Loading Device Tree to 4ec17000, end 4ec2519b ... OK
fdt fixup ethernet

Starting kernel ...

```
[ 0.192295] leg_rev v[3]
[ 0.192319] phy-type [3] [ETH]
[ 0.192327] external phy clock
[ 0.193108] imx6q-pinctrl 20e0000.iomuxc: no fsl,pins property in node /soc/aips-
bus@02000000/iomuxc@020e0000/usbh1/usbh1_alt_grp-1
[ 0.505006] PFUZE Init bc210c00
[ 0.505449] enabling COINCELL CHRG [0c:0]
[ 0.505885] enabling COINCELL CHRG [0c:0][ 0.578570] leg_rev v[3]
[ 0.587002] imx6q-pinctrl 20e0000.iomuxc: pin MX6Q_PAD_EIM_D22 already requested by
20e0000.iomuxc; cannot claim for 2184000.usb
[ 0.598631] imx6q-pinctrl 20e0000.iomuxc: pin-42 (2184000.usb) status -22
[ 0.605474] imx6q-pinctrl 20e0000.iomuxc: could not request pin 42 (MX6Q_PAD_EIM_D22) from
group usbotggrp-1 on device 20e0000.iomuxc
[ 0.617600] imx_usb 2184000.usb: Error applying setting, reverse things back
[ 0.795776] sdhci-esdhc-imx 219c000.usdhc: set ultra high speed state.
[ 0.950863] caam_jr 2101000.jr0: 20000b11: CCB: desc idx 11: AES: Mode error.
[ 0.958046] alg: aead: encryption failed on test 1 for rfc4106-gcm-aes-caam: ret=-536873745
[ 0.966729] caam_jr 2101000.jr0: 20000c11: CCB: desc idx 12: AES: Mode error.
[ 0.973903] alg: aead: encryption failed on test 1 for gcm-aes-caam: ret=-536874001
[ 1.006552] snvs-secvio 20cc000.caam-snvs: can't get snvs clock
Verification successful
```

[10.071331] leg_rev v[3]

Poky (Yocto Project Reference Distro) 2.0.1 imx6qleg-ucm-c /dev/ttyMXC4

imx6qleg-ucm-c login:

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imx6qleg-ucm-c login: