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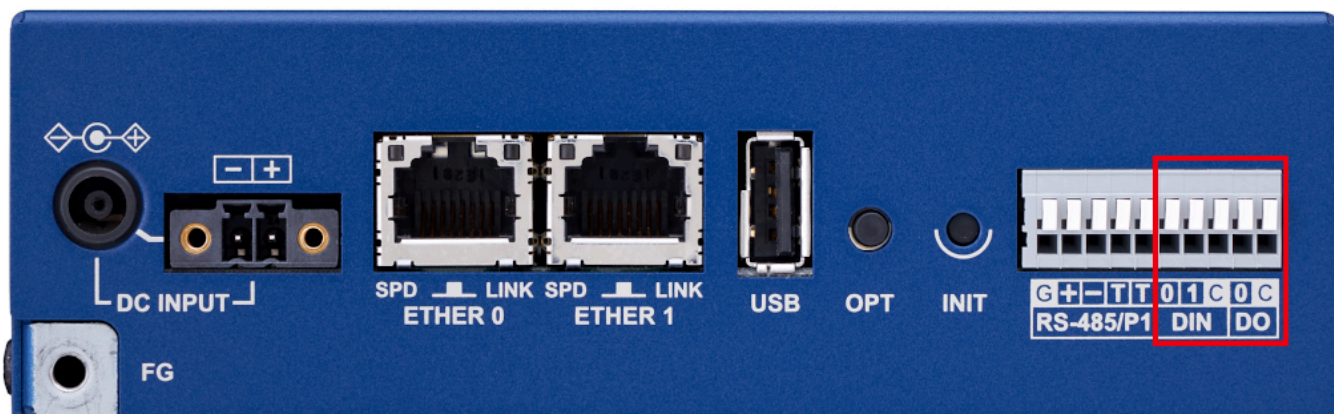
DI/DO の利用 [Use of DI/DO]

MA-X3xx シリーズは、

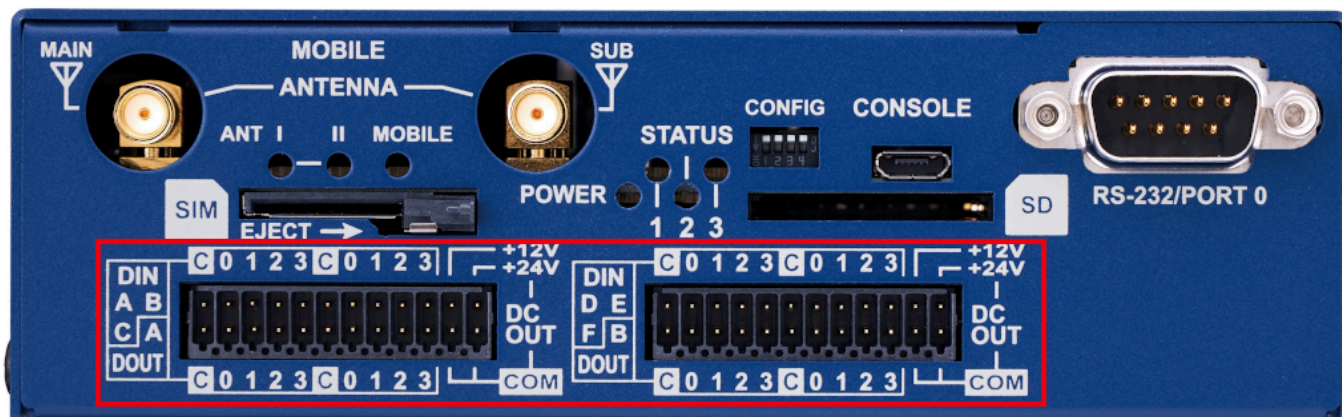
1. 標準版 [standard] (拡張なし、メインボード側): DI 2ch / DO 1ch
2. DI/DO/AI 拡張 [extended] (/LAD, 拡張ボード側): 1. に加えて [DI 24ch / DO 8ch]

を使用することができます。

標準版 [standard]



/AD [extended]



※ /AD [extended] には24ピン着脱式スクリーレス端子台が同梱されて

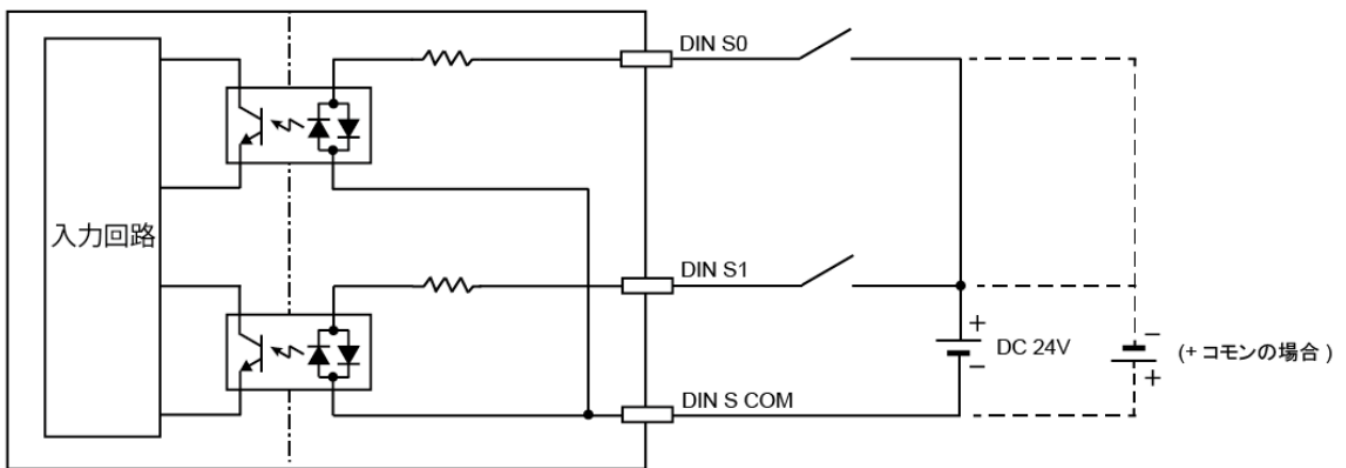
います □ □Phoenix contact製 DMC 0,5/12-G1-2,54 P20 THR R72 □接続ケーブルAWG26 □AWG20対応)

DI の使用 □ Use of DI □

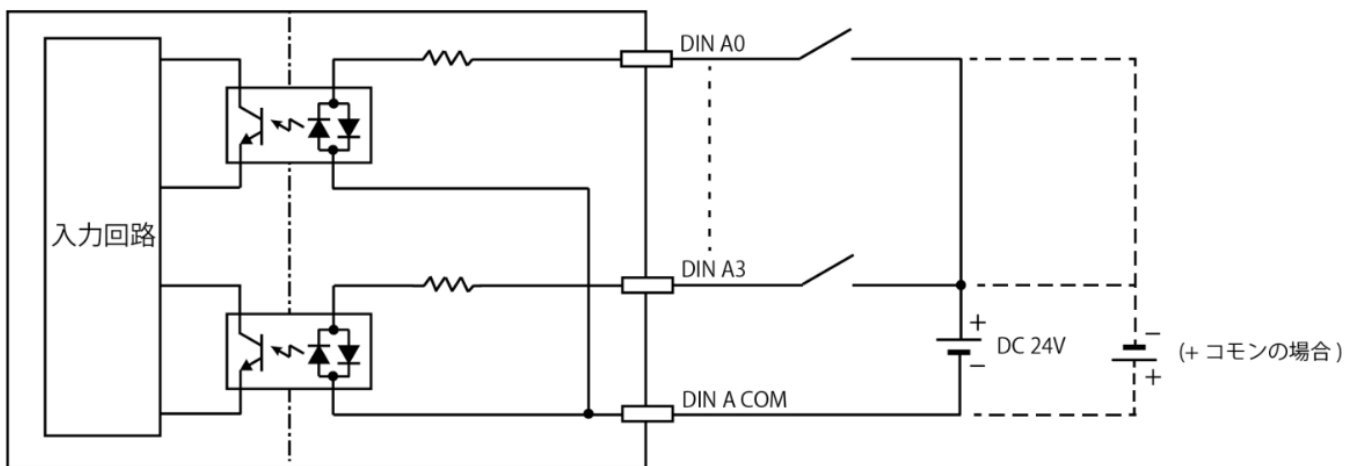
仕様

等価回路

メインボード側 (standard □



拡張ボード側 (extended □



DI 部はフォトカプラ及び電流制限抵抗により構成されています。また、外部電源の接続方法によりマイナスコモン、及びプラスコモンの機器と接続が可能です。グループ毎に共通コモンとなっています。

□The DI section consists of a photocoupler and a current limiting resistor. Depending on the external power supply connection method, it can be connected to devices with negative common or positive

common. The common is common for each group.

アクセス

従来使用していた sysfs GPIO が deprecated で廃止予定のため、libgpiod を利用してアクセスします。(Since sysfs GPIO used in the past is deprecated and scheduled to be discontinued, libgpiod is used for access.)

- [参考] [Stop using /sys/class/gpio - it's deprecated](#)

メインボード側 (standard)

No.	Name	Note
1	DIN_S0	
2	DIN_S1	

拡張ボード側 (extended)

No.	Name(フィルタ無)	Name(フィルタ有)	Note
1	EXT_DI0	Filtered_DI0	A0
2	EXT_DI1	Filtered_DI1	A1
...
11	EXT_DI10	Filtered_DI10	C2
12	EXT_DI11	Filtered_DI11	C3
13	EXT_DI12	Filtered_DI12	D0
14	EXT_DI13	Filtered_DI13	D1
...
23	EXT_DI22	Filtered_DI22	F2
24	EXT_DI23	Filtered_DI23	F3

フィルタについて: 64Hz 2bit シフトレジスタ を利用したステートマシンによるチャタリング除去フィルタが入っています。

[About the filter: A state machine chatter removal filter using 64Hz 2bit shift registers is included.]

```

root@metis:~# gpioinfo |egrep "DIN_S|DI[0-9]+"
```

line 60:	"DIN_S0"	unused	input	active-high
line 61:	"DIN_S1"	unused	input	active-high
line 0:	"EXT_DI12"	unused	input	active-high
line 1:	"EXT_DI13"	unused	input	active-high
line 2:	"EXT_DI14"	unused	input	active-high
line 3:	"EXT_DI15"	unused	input	active-high
line 4:	"EXT_DI16"	unused	input	active-high
line 5:	"EXT_DI17"	unused	input	active-high
line 6:	"EXT_DI18"	unused	input	active-high
line 7:	"EXT_DI19"	unused	input	active-high
line 8:	"EXT_DI20"	unused	input	active-high
line 9:	"EXT_DI21"	unused	input	active-high
line 10:	"EXT_DI22"	unused	input	active-high

```
line 11: "EXT_DI23"      unused  input  active-high
line 16: "Filtered_DI12" unused  input  active-high
line 17: "Filtered_DI13" unused  input  active-high
line 18: "Filtered_DI14" unused  input  active-high
line 19: "Filtered_DI15" unused  input  active-high
line 20: "Filtered_DI16" unused  input  active-high
line 21: "Filtered_DI17" unused  input  active-high
line 22: "Filtered_DI18" unused  input  active-high
line 23: "Filtered_DI19" unused  input  active-high
line 24: "Filtered_DI20" unused  input  active-high
line 25: "Filtered_DI21" unused  input  active-high
line 26: "Filtered_DI22" unused  input  active-high
line 27: "Filtered_DI23" unused  input  active-high
line  0: "EXT_DI0"       unused  input  active-high
line  1: "EXT_DI1"       unused  input  active-high
line  2: "EXT_DI2"       unused  input  active-high
line  3: "EXT_DI3"       unused  input  active-high
line  4: "EXT_DI4"       unused  input  active-high
line  5: "EXT_DI5"       unused  input  active-high
line  6: "EXT_DI6"       unused  input  active-high
line  7: "EXT_DI7"       unused  input  active-high
line  8: "EXT_DI8"       unused  input  active-high
line  9: "EXT_DI9"       unused  input  active-high
line 10: "EXT_DI10"      unused  input  active-high
line 11: "EXT_DI11"      unused  input  active-high
line 16: "Filtered_DI0"  unused  input  active-high
line 17: "Filtered_DI1"  unused  input  active-high
line 18: "Filtered_DI2"  unused  input  active-high
line 19: "Filtered_DI3"  unused  input  active-high
line 20: "Filtered_DI4"  unused  input  active-high
line 21: "Filtered_DI5"  unused  input  active-high
line 22: "Filtered_DI6"  unused  input  active-high
line 23: "Filtered_DI7"  unused  input  active-high
line 24: "Filtered_DI8"  unused  input  active-high
line 25: "Filtered_DI9"  unused  input  active-high
line 26: "Filtered_DI10" unused  input  active-high
line 27: "Filtered_DI11" unused  input  active-high
root@metis:~#
```

gpiod のアプリケーションによるアクセス Access by gpiod applications

gpiod パッケージのアプリケーションでアクセスします。

GPIO の検索 GPIO Search

USER

```
root@metis:~# gpiofind EXT_DI10 gpiochip3 10
```

GPIO 値の読取 [Read GPIO values]

USER

```
root@metis:~# gpioget `gpiofind EXT_DI11` 0 root@metis:~#
```

プログラムによるアクセス [Programmatic Access]

libgpiod を使用してプログラムを作成します。

- [参考] [libgpiodの使い方 - Qiita](#)

[Nim 用の binding](#) を作成したので C 言語より簡単にプログラムをすることもできます。

```
import std/asyncthread
import std/times
import nim_gpiod

proc asyncMain() {.async.} =
  let di0 = newGpio("DIN_S0", "NimGPIO")
  if di0.isNil:
    echo "newGpio failed."
    quit(1)
  while true:
    echo "wait event..."
    let event = await di0.wait_event(Edge.Both, 10)
    let now = now().format("yyyy-MM-dd HH:mm:ss")
    echo &"*** {now}: Event! (edge: {event.edge}, value: {event.value})"

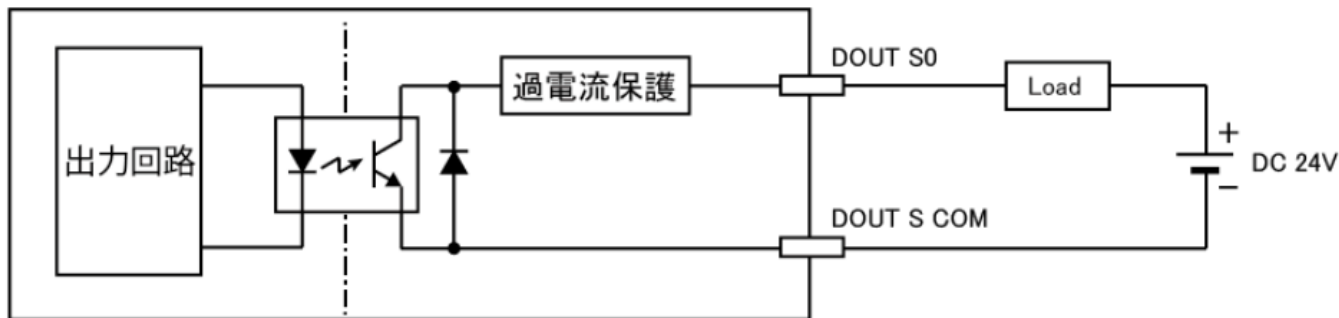
waitFor asyncMain()
```

DO の使用 [Use of DO]

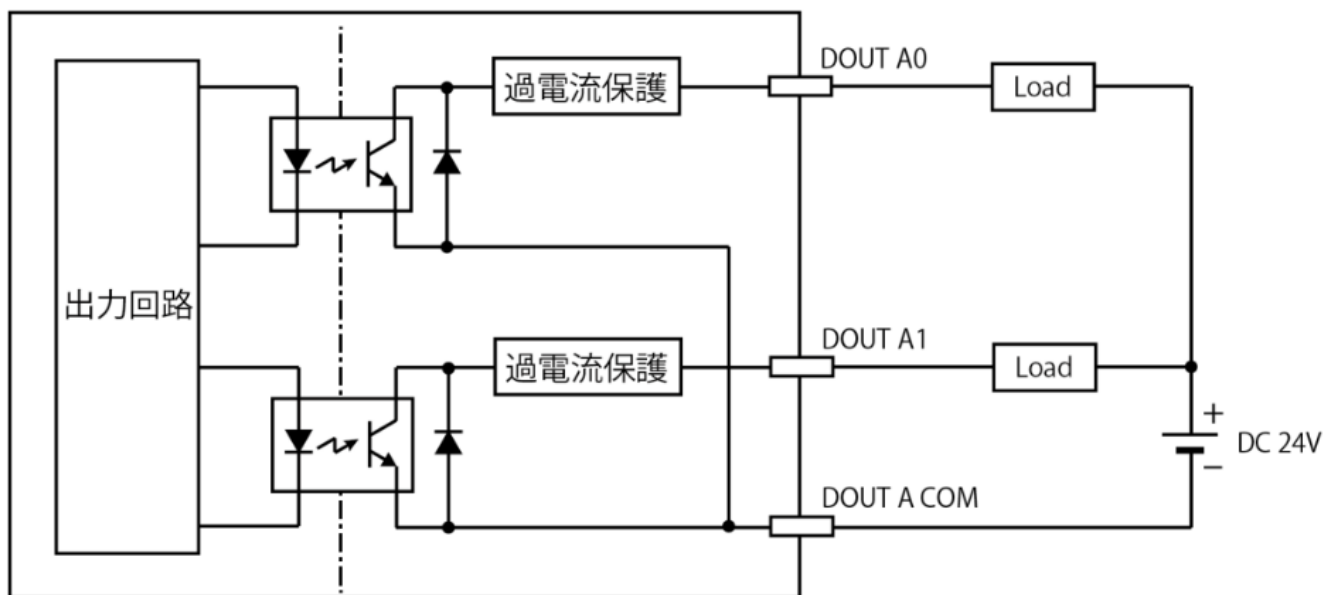
仕様

等価回路

メインボード側 (standard)



拡張ボード側 (extended)



DO 部はフォトカプラ及び過電流保護素子により構成されています。グループ毎に共通コモンとなっています。
 (The DO section consists of a photocoupler and an overcurrent protection element. Each group has a common common.)

アクセス(Access)

LED class driver にバインドしています (Bound to LED class driver.)

USER

```
root@metis:/sys/class/leds# ls ADC_Power EXT_DO0 EXT_DO6 MSP430_EXT2_TEST MobileLED_R0
PowerLED:G system-status1:g ADC_RESET EXT_DO1 EXT_DO7 MSP430_RST MobileLED_R1
SHUTDOWN_REQ system-status1:r ConsoleEnable EXT_DO2 LED_Drv_Enable MSP430_TEST
MobileLED_R2 USBHub_Reset system-status2:g DO_S0 EXT_DO3 MSP430_EXT1_RST MobileLED_G0
PCIe_Power mmc0:: system-status2:r DO_T0 EXT_DO4 MSP430_EXT1_TEST MobileLED_G1 PHY0_Reset
mmc1:: system-status3:g EXT_24V_ON EXT_DO5 MSP430_EXT2_RST MobileLED_G2 PHY1_Reset
power-stat:r system-status3:r
```


メインボード側 (standard)

No.	Name	Note
1	DO_S0	

拡張ボード側 (extended)

No.	Name	Note
1	EXT_DO0	
...	...	
8	EXT_DO7	

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