



# APPLICATION NOTE

## XRF410N™

### Installation

Reference Software Versions:

1.4.0 and later

## History

Issue	Date	Paragraph	Change
Rev. 0	February 13, 2015		First Release
Rev. A	March 24, 2015		Added baud rate note
Rev. B	June 9, 2015		Added Electrical connection diagrams and power supply table.
Rev. C	April 2016		Added CAB-MLP-05 wiring info
Rev. D	April, 2017		Changed power supply table.

## INTRODUCTION

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XRF410N (named for its eXtended Reading Field), is a product developed mainly for T&L applications with the goal of guaranteeing an extended horizontal field of view in order to fully cover the entire width of a conveyor.

It is made up of two Matrix 410N™ model readers (optically pre-configured and not modifiable). The readers are mounted onto a metal plate at a pre-defined distance from each other (pitch), which depends on the optical model. They are also connected together electrically by the ID-NET™ network.

The system therefore is pre-assembled and pre-configured to provide simpler installation.

Each M410N-XRF reader (including spare part readers) can only be used within an ID-NET network in which at least one other reader is present. **They cannot be used as Stand Alone devices.**

The various XRF410N models do not include CBX connection boxes or CBX connecting cables so it is necessary to refer to the accessories list tables for the required material.

In terms of product performance there are two models:

- **BP (Base Performance)** for low cost applications and medium line speed. These models have High Power Super Narrow Angle illuminators and use Image Cropping (to avoid the presence of multiple packs inside the acquired image simultaneously).
- **HP (High Performance)** for high line speed applications. These models have Ultra High Power illuminators and use full-frame images in PackTrack™ mode.

In addition, each of these is further divided into different optical models which are optimized for different code resolutions, reading distances and field of view.

The following table summarizes the main characteristics of the various models:

Model XRF410N	1D Code Resolution	Pitch [mm]	Lighting System	Reading Distance [mm]	DOF [mm]	Focus Dist. [mm]	PPI	FOV min. [mm]	Overlap min between readers [mm]	Others
BP- B0x Medium Res	0.38mm (15mils)	235	LT-10	1270- 1670	400	1570	91	590	120	Cropped Image: 1600x780
BP- B1x High Res	0.33mm (13mils)	175	LT-10	1050- 1450	400	1300	111	470	120	Cropped Image 1600x780
HP- H0x Medium Res	0.38mm (15mils)	235	LT-20	1270- 1670	400	1570	91	590	120	Full image & Packtrack
HP- H1x High Res	0.33mm (13mils)	175	LT-20	1050- 1450	400	1300	111	470	120	Full image & Packtrack
HP- H2x Very High Res	0.25mm (10mils)	155	LT-20	860-1110	250	960	147	395	85	Full image & Packtrack

**Table 1 – Main Characteristics**

In order to create multi-side or multi-point reading stations, the product line further includes the following models:

- **XRF410N-xx0 MASTER:** made up of two readers: one Master and one Slave 1. The Master must be connected directly to a **CBX** connection box through a **CAB-DS-xx-S** cable. The Slave is already connected to a QL100 which is provided with a CBL-1490 ID-NET network terminator. The other end of the QL100 must be connected to the CBX using a **CBL-1480-xx** cable to complete the ID-NET network.
- **XRF410N-xx1 EXTENSION:** made up of two Slave readers each connected to a QL100. These models must be connected to a **Master XRF410N** through the ID-NET network using a **CBL-1480-xx** cable to complete the ID-NET network.

One or more Extension XRF410N models can be chained together to extend the ID-NET network. When using the Extension models, the CBL-1490 ID-NET network terminator (present on the QL100 of the Slave reader on the Master XRF410N) must be transferred to the last slave on the last Extension XRF410N in the network.

The complete list of XRF410N models is:

Description	Part Number
XRF410N-B00 2HD_MED RES_MASTER	937400028
XRF410N-B10 2HD_HI RES_MASTER	937400029
XRF410N-H00 2HD_HI PERF_MED RES_MASTER	937400030
XRF410N-H10 2HD_HI PERF_HI RES_MASTER	937400031
XRF410N-H20 2HD_HI PERF_VHI RES_MASTER	937400032
XRF410N-B01 2HD_MED RES_EXTENSION	937400033
XRF410N-B11 2HD_HI RES_EXTENSION	937400034
XRF410N-H01 2HD_HI PERF_MED RES_EXTENS	937400035
XRF410N-H11 2HD_HI PERF_HI RES_EXTENS	937400036
XRF410N-H21 2HD_HI PERF_VHI RES_EXTENS	937400037

The list of XRF410N accessories used to complete each installation is:

Required Accessories for XRF410N Base Performance Models				
Description	1 Module	2 Modules	4 Modules	Part Number
XRF410N-B00 2HD_MED RES_MASTER	1	1	1	937400028
XRF410N-B01 2HD_MED RES_EXTENSION	-	1	3	937400033
CAB-ETH-M05 M12-IP67 ETHERNET CABLE (5M)	2	4	8	93A051348
CBL-1480-05 M12/5P MALE/FEMALE 5M IDNET	1	1	1	93A050051
CBL-1480-02 M12/5P MALE/FEMALE 2M IDNET	-	1	3	93A050050
CAB-DS05-S M12-IP67 TO CBX 5M	1	1	1	93A050060
CBX500 ATS-001 ASSEMBLY	1	1	1	93A301083
MEP-593 PHOTOCELL KIT	1	1	1	93ACC1791
OEK-2 OPTICAL ENCODER (CAB 10M+SPRING)	1	1	1	93ACC1770
BA400 M12 3P M. PANEL CONN. (EXT.POWER)	1	1	-	93ACC1853
CAB-PG-0002 VDC PWR PG120-IDNET 2M	1	1	-	93ACC1870
PG-120-K01 PWR SUPPLY KIT FOR M450 (EU)	1	1	-	93ACC0046
PWR-480B POWER UNIT 110/230VAC 24V	-	-	1	93ACC0076

The OEK-2 Encoder is necessary when using PackTrack Operating Mode.

Required Accessories for XRF410N High Performance Models				
Description	1 Module	2 Modules	4 Modules	Part Number
XRF410N-H10 2HD_HI PERF_HI RES_MASTER	1	1	1	937400031
XRF410N-H11 2HD_HI PERF_HI RES_EXTENS	-	1	3	937400036
CAB-ETH-M05 M12-IP67 ETHERNET CABLE (5M)	2	4	8	93A051348
CBL-1480-05 M12/5P MALE/FEMALE 5M IDNET	1	1	1	93A050051
CBL-1480-02 M12/5P MALE/FEMALE 2M IDNET	-	2	6	93A050050
CAB-DS05-S M12-IP67 TO CBX 5M	1	1	1	93A050060
CBX500 ATS-001 ASSEMBLY	1	1	1	93A301083
CAB-MLP-05 MULTI LIGHTING POWER 5M	1	1	1	93A050084
MEP-593 PHOTOCCELL KIT	1	1	1	93ACC1791
OEK-2 OPTICAL ENCODER (CAB 10M+SPRING)	1	1	1	93ACC1770
BA400 M12 3P M. PANEL CONN. (EXT.POWER)	1	-	-	93ACC1853
CAB-PG-0002 VDC PWR PG120-IDNET 2M	1	-	-	93ACC1870
PG-120-K01 PWR SUPPLY KIT FOR M450 (EU)	1	-	-	93ACC0046
PWR-480B POWER UNIT 110/230VAC 24V	-	1	1	93ACC0076

The OEK-2 Encoder is necessary when using PackTrack Operating Mode.

In addition, the following single Spare Part replacement readers (relative to the specific XRF410N model) available for order;

Description	Part Number
MATRIX 410N XRF-B0x SPARE UNIT-REPLMNT	937400038
MATRIX 410N XRF-B1x SPARE UNIT-REPLMNT	937400039
MATRIX 410N XRF-H0x SPARE UNIT-REPLMNT	937400040
MATRIX 410N XRF-H1x SPARE UNIT-REPLMNT	937400041
MATRIX 410N XRF-H2x SPARE UNIT-REPLMNT	937400042

## INSTALLATION

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### GENERAL ID-NET CONFIGURATION

- When using a single XRF410N-xx0 MASTER, no ID-NET network configuration is necessary. This product leaves the factory pre-configured and the readers have respective Master and Slave 1 roles.
- When using one or more XRF410N-xx1 EXTENSION(s) with the XRF410N-xx0 MASTER, the first step is to configure the ID-NET network because the EXTENSION Slave readers leave the factory with the unusable Slave 0 role (jolly).

The installation procedure for multi XRF readers is summarized below:

1. Mount the various XRF410Ns to the station frame.
2. Connect the ID-NET cabling, moving the ID-NET terminator to the last node in the network.
3. Run DL.CODE™ and connect to the Master reader.
4. Run “New Configuration - Multi Device. This will assign ID-NET addresses to all the Slaves in the network associating them with their respective serial numbers. Click **Apply Changes**.



**CAUTION:** XRF410N models have a default baudrate of 1 Mbs and are designed to be used in applications where the overall cable length does not exceed 30 meters. XRF410N models can only be connected in an ID-NET network to other XRF410N models; mixed networks with other types of Matrix readers are not allowed.

### POWER REQUIREMENTS

Depending on the number of XRF410Ns used a different power supply will be required. The following table indicates which power supply to use for your application.

XRF410N Model	Number of Modules			
	1	2	3 to 4	5 to 8
Base (Bxx)	PG-120-K0x	PG-120-K0x	PWR-480B	PWR-480B
Hi Perf (Hxx)	PG-120-K0x	PWR-480B	PWR-480B	PWR-480B (x2)

## DIRECT MOUNTING

For Top direct applications mount the positioning bracket to the Bosch frame using the two T-bolts and nuts through the **slots** in the bracket.

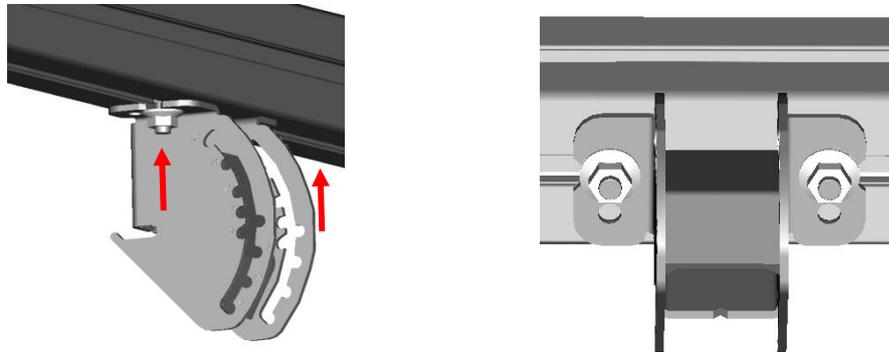


Figure 1 – Positioning Bracket Mounting to Frame

Next, install the front mounting bolt so that the XRF410N rests on the positioning bracket. This allows positioning to be done without having to physically support the weight of the XRF410N.

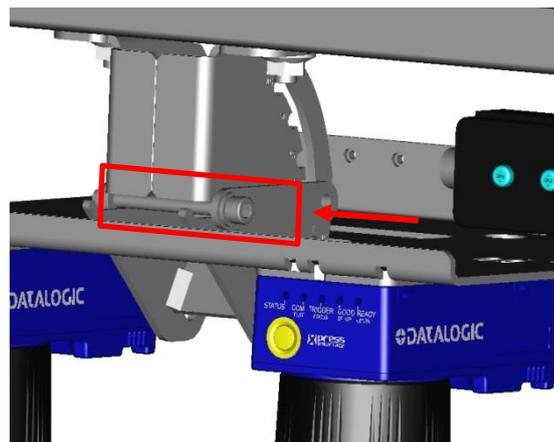


Figure 2 – XRF410N Mounting to Positioning Bracket

Now insert the back mounting bolt and position the plate into one of the pre-defined slots corresponding to the correct application angle. The angles are marked on the positioning bracket. The standard TOP installation is 15°.

When using multiple Modules on the same plane (Master + Extension(s)), the distance between readers must be maintained from one module to the next to guarantee uniform image acquisition overlapping.

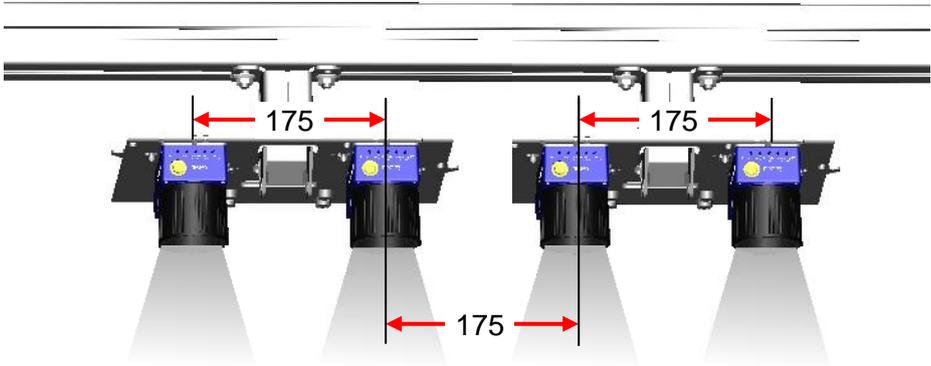


Figure 3 – Maintaining Pitch Between Multiple Modules

### Example Mounting Distance for XRF410N B0x Models

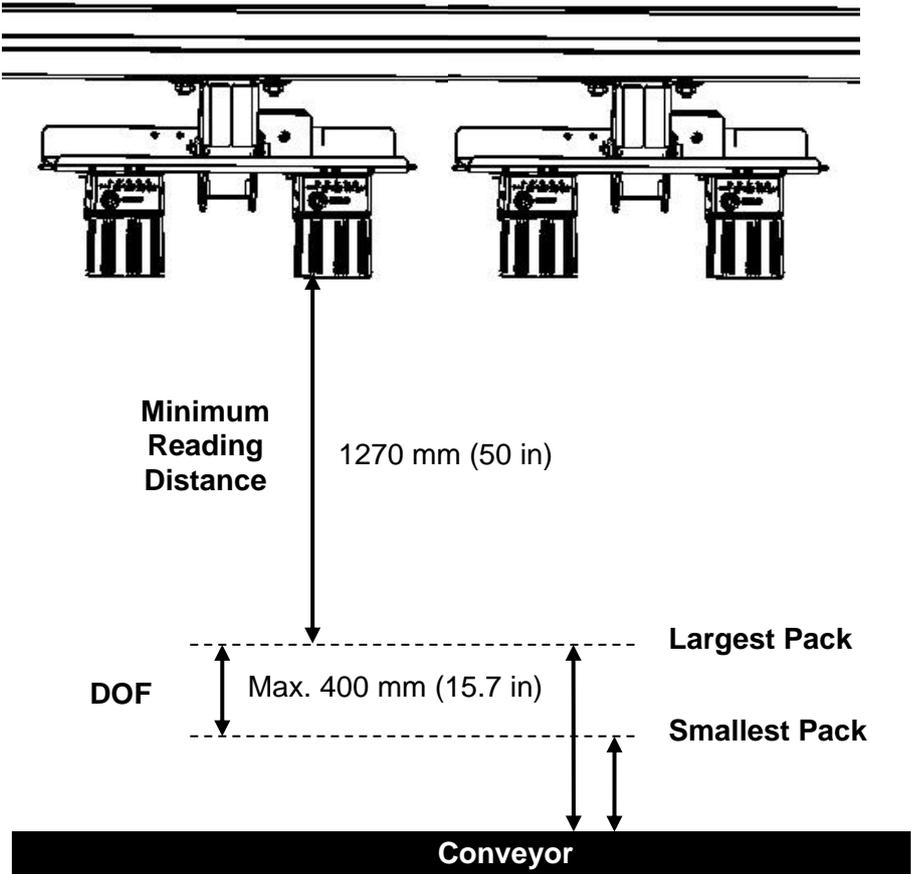


Figure 4 – Example Reading Distance Reference

DOF and Minimum Reading Distance data for each XRF410N model are given in Table 1 – Main Characteristics.

## MOUNTING WITH EMK MIRRORS

Accessory EMK-600 External Deflection Mirrors (as well as some other models), can be mounted in all applications where it is not practical to use the full DOF of the reader. In these cases a more compact reading station can be constructed. This is particularly useful in side reading applications.

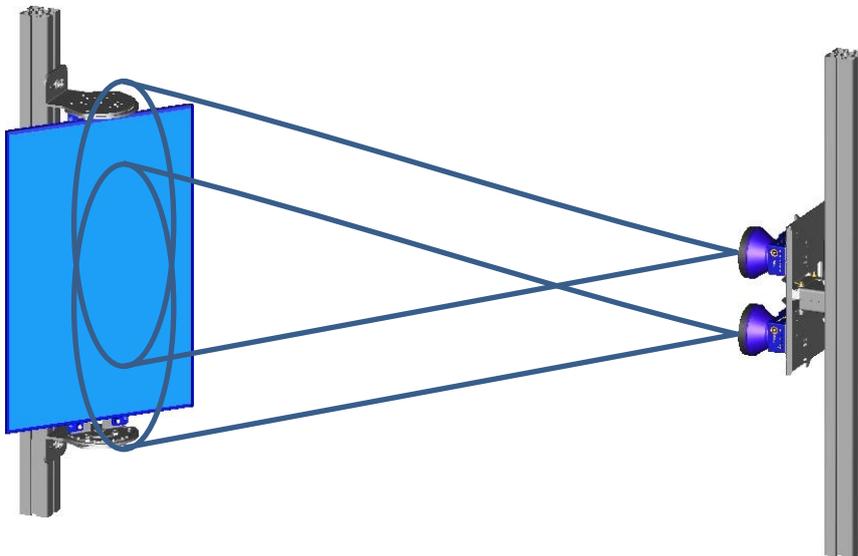
The following paragraphs describe common mounting positions which help maintain reader to mirror alignment, however many variations can be constructed.



**NOTE:** For all of the following mounting examples, the positioning distances are not given since they depend on the application and characteristics of the reader, (lens, focus, etc.). Follow your application drawings for this information.



**CAUTION:** Do not mount the reader so far from the mirror that the reading area extends outside of the mirror surface.



The EMK Mirror Bracket has some pre-defined skew angle slots to facilitate mounting. **These are the angles that will be projected onto the conveyor surface (reflection angles).**

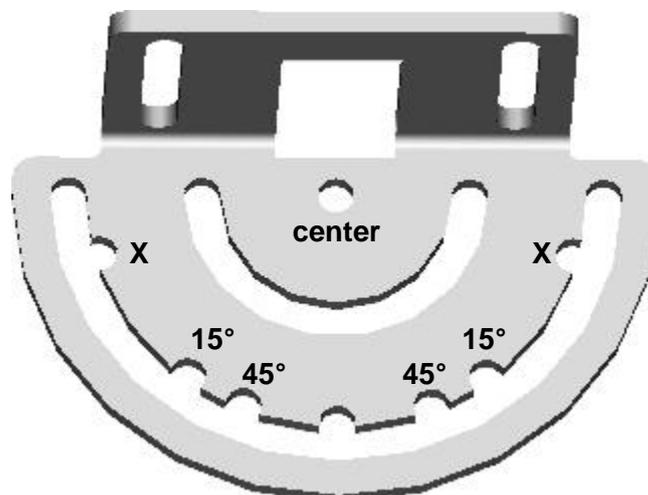
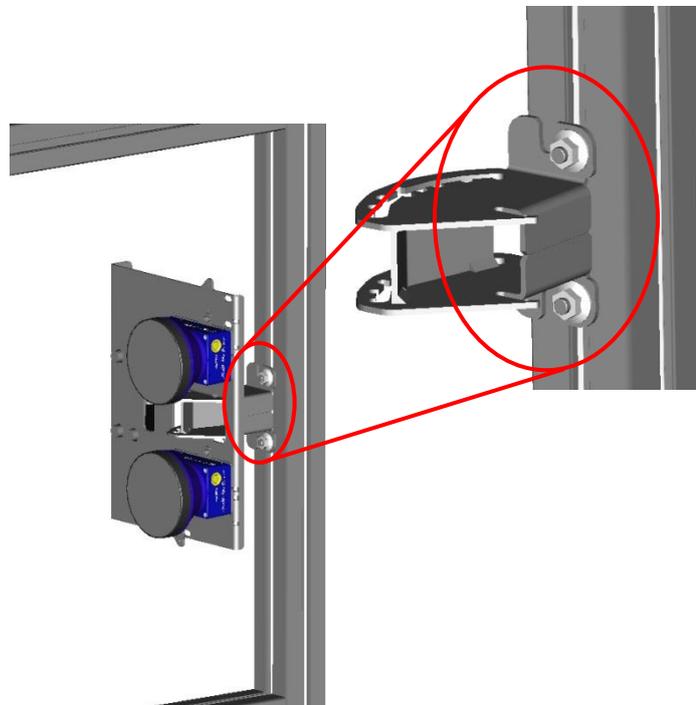
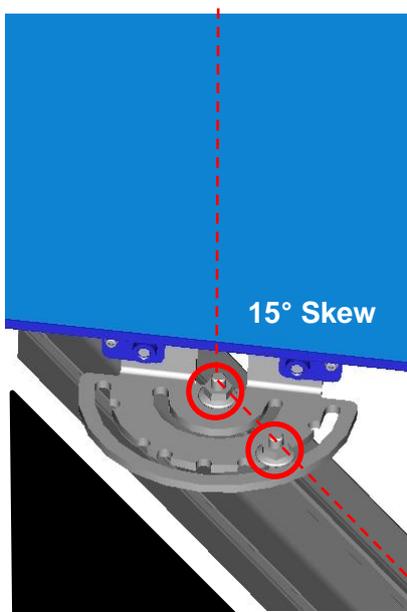
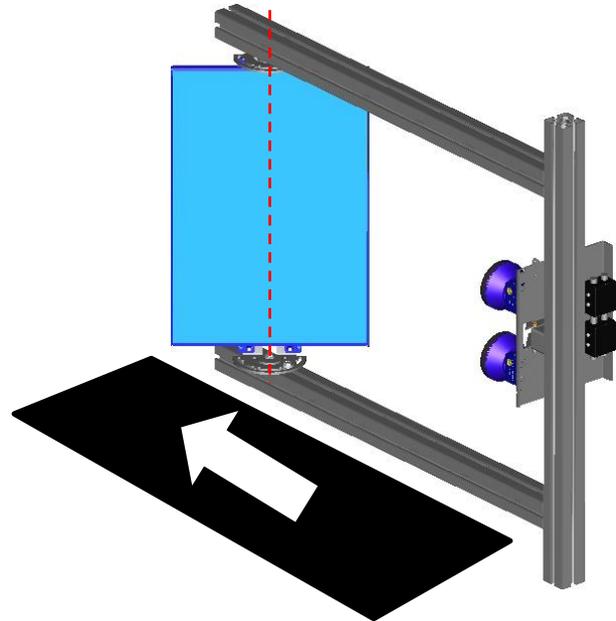


Figure 5 – Mirror Mounting Bracket

## EMK-600 Side Mount - Standard

XRF410N and EMK-600 Mirror alignment is maintained when the EMK is mounted directly to the frame profiles. The skew angle is made at the mirror instead of at the reader.

1. Mount the mirror brackets to the profiles with one bolt in the center position and one bolt in the outer ring.
2. Rotate the mirror brackets so that the 15° skew angle slot is aligned with the profile channel, (see the figure below).
3. Mount the XRF410N assembly bracket to the profile using the through-holes (not the slots).
4. Move the mirror assembly to the correct distance from the reader according to your application.
5. Move the Matrix XRF410N assembly vertically to center it on the mirror.
6. Tighten the bolts.



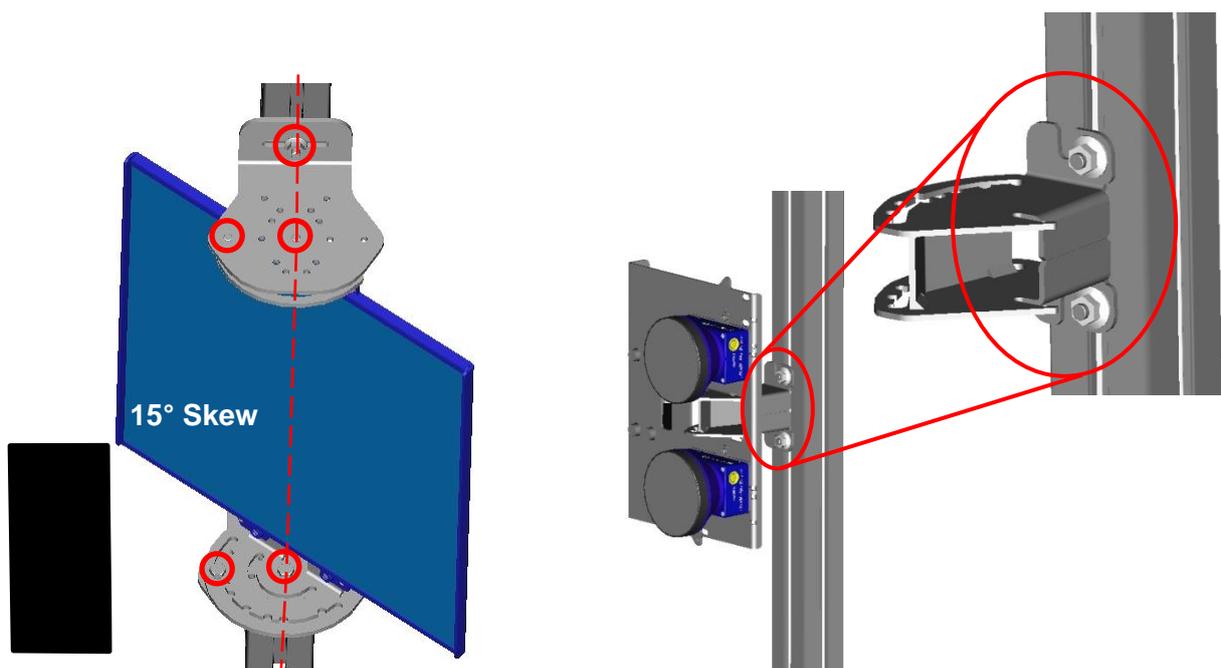
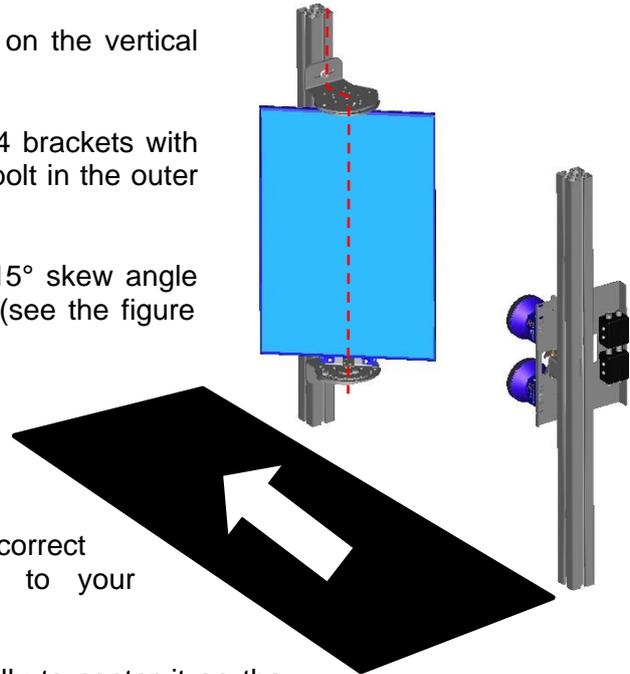
## EMK-600 Side Mount - Alternative

An alternative mounting solution is to use the ST-344 Bracket. XRF410N and EMK-600 Mirror alignment is obtained when the EMK is centered to the frame profiles as shown in the figures below. This bracket also provides the freedom of applying offsets to the mirror where necessary.



**NOTE:** The ST-344 Bracket is an accessory for the EMK-600 Deflection Mirror.

1. Mount and center the ST-344 brackets on the vertical profile.
2. Mount the mirror brackets to the ST-344 brackets with one bolt in the center position and one bolt in the outer ring.
3. Rotate the mirror brackets so that the 15° skew angle slot is aligned with the profile channel, (see the figure below).
4. Mount the XRF410N assembly bracket to the profile using the through-holes (not the slots).
5. Move the mirror assembly to the correct distance from the reader according to your application.
6. Position the XRF410N assembly vertically to center it on the mirror.
7. Tighten the bolts.



# ELECTRICAL CONNECTIONS

## Single Master Base Model Applications

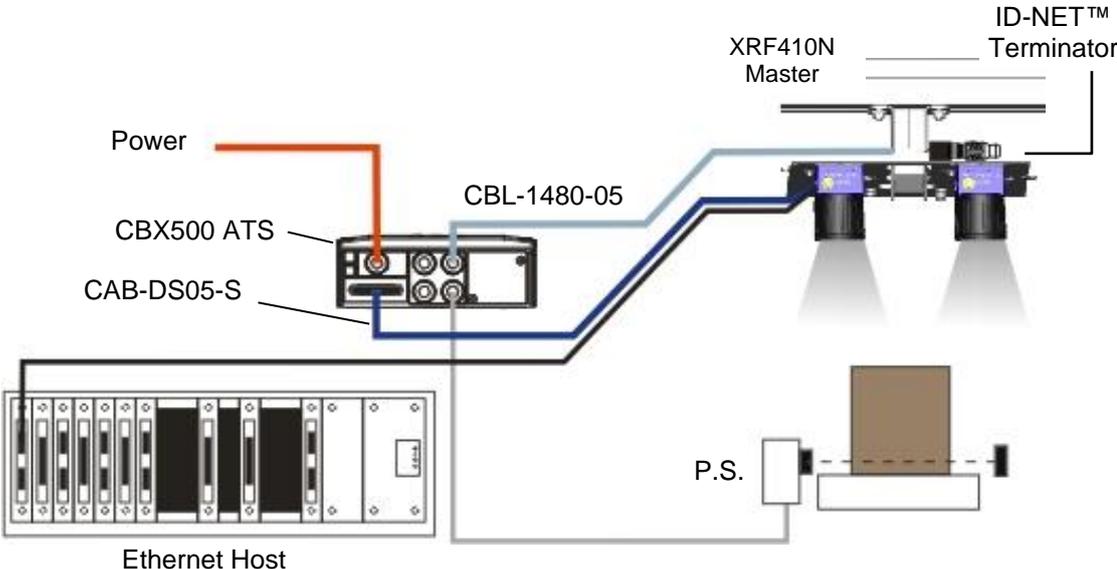


Figure 6 -Bxx Single Module Electrical Connections

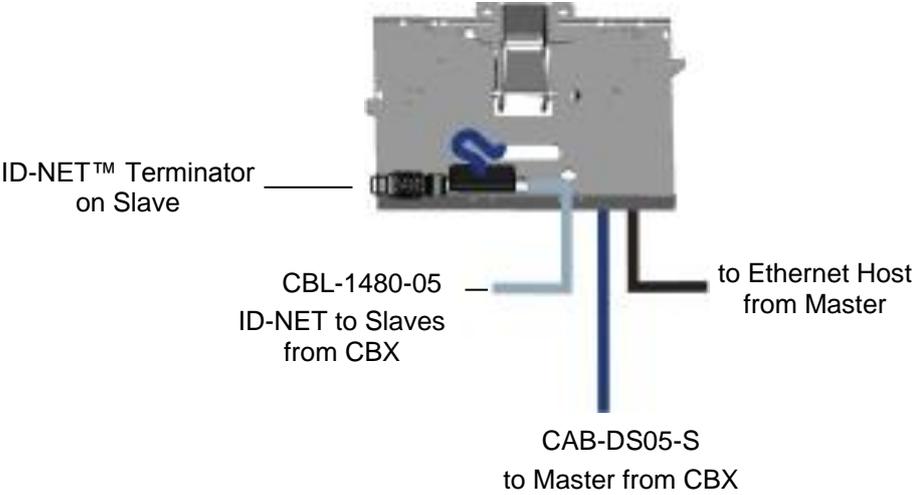


Figure 7 -Bxx Single Module Electrical Connections (back view)

### Multiple Base Model Applications (Master + Extensions)

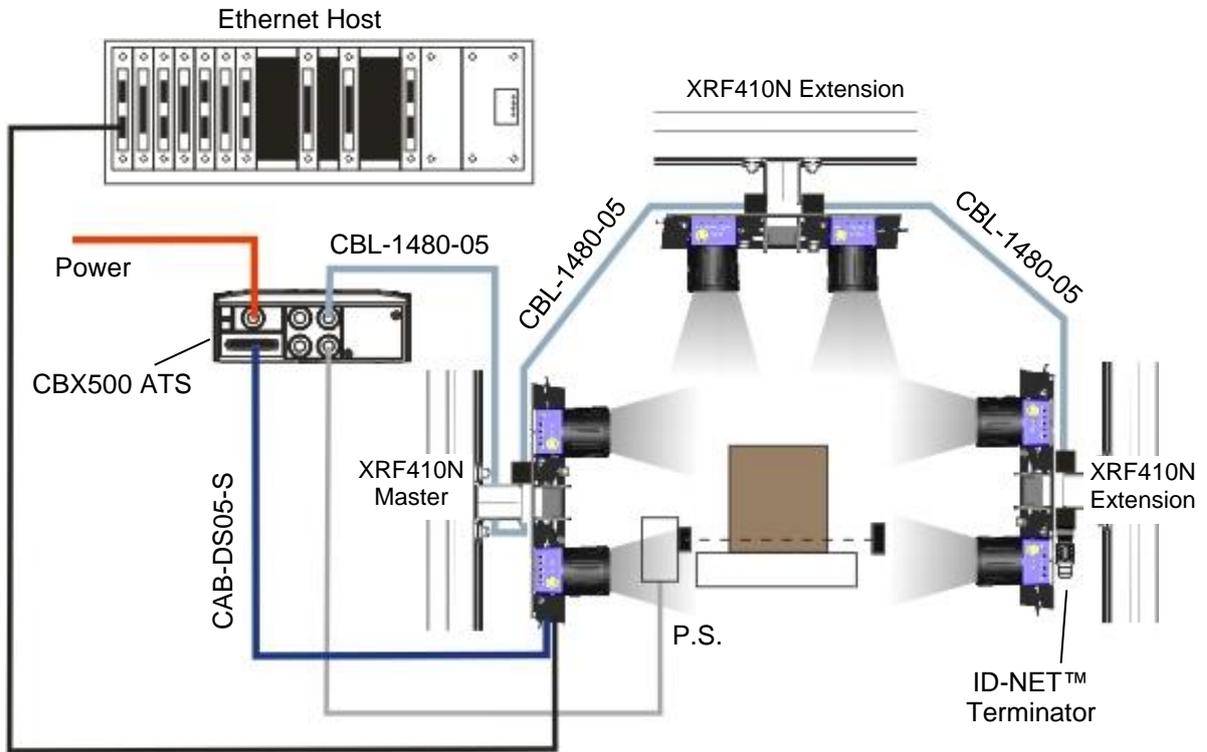


Figure 8 – Bxx Multiple Module Electrical Connections

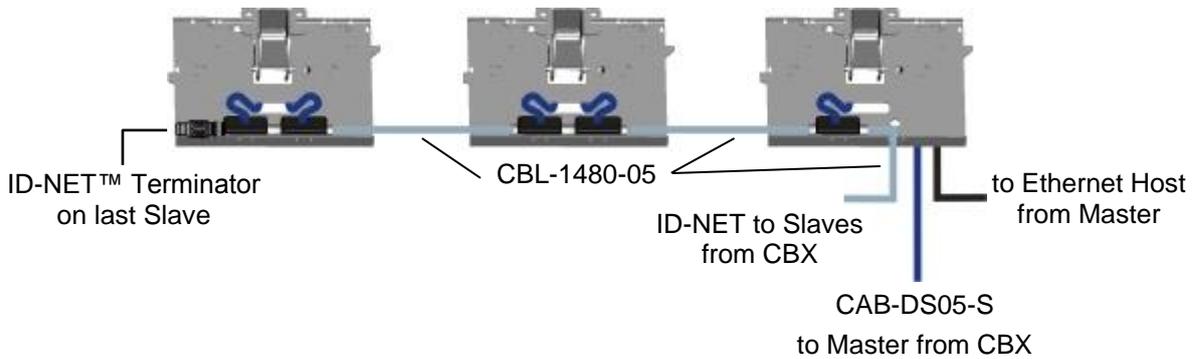


Figure 9 – Bxx Multiple Module Electrical Connections (back view)

### Single Master Hi Performance Model Applications

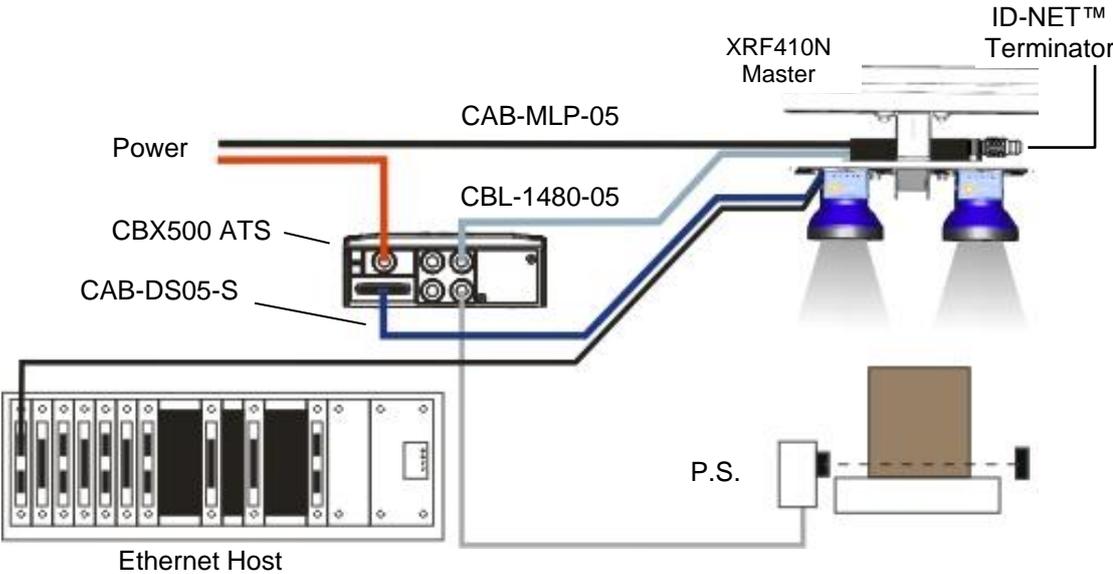


Figure 10 –Hxx Single Module Electrical Connections

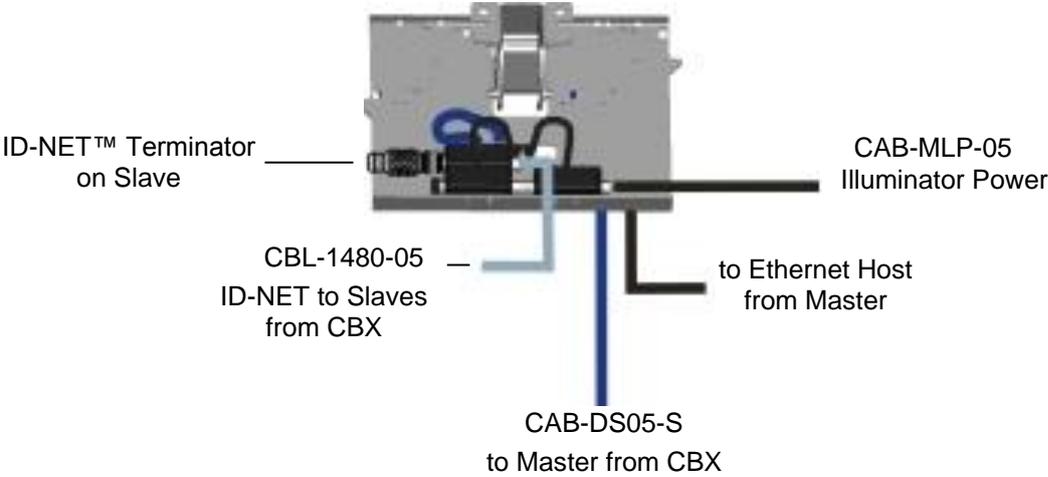


Figure 11 –Hxx Single Module Electrical Connections (back view)



**NOTE:** The CAB-MLP-05 Illumination Power cable is connected directly to the power supply. Connect the **White** wire to Vdc and **Blue** wire to GND. Connect the cable shield to Earth ground.



### 6 Module Hi Performance Model Applications (Master + Extensions)

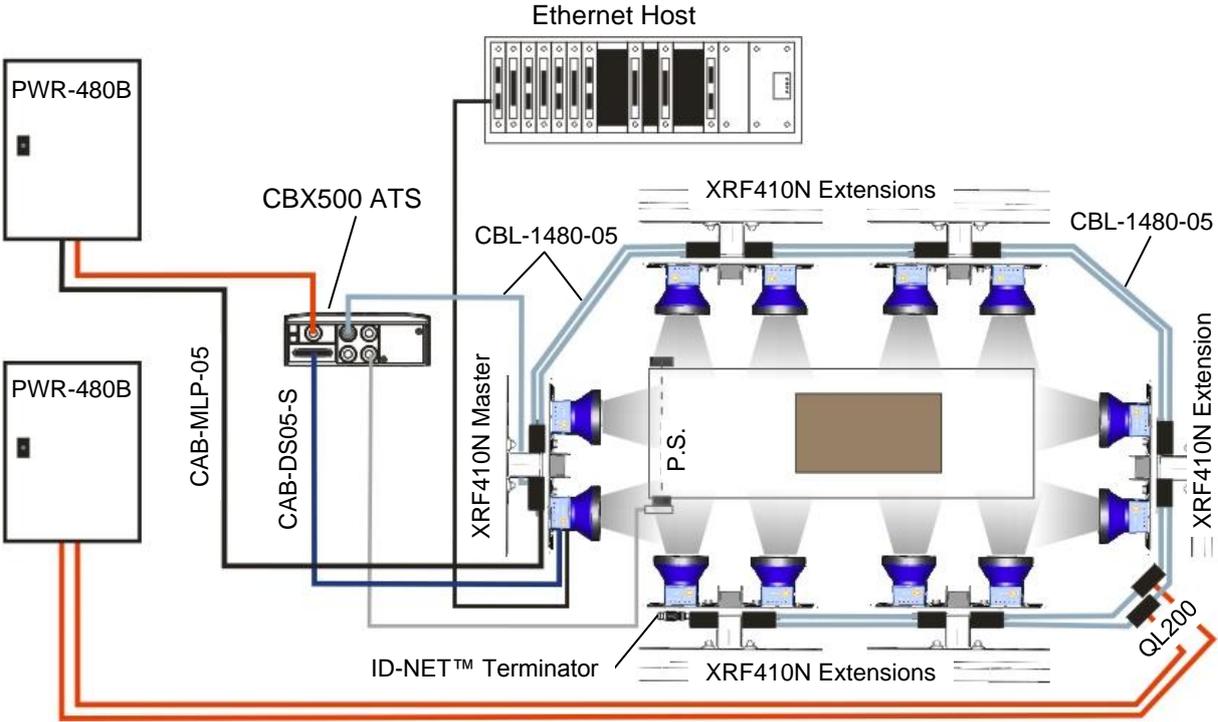


Figure 14 – Hxx 6 Module Electrical Connections

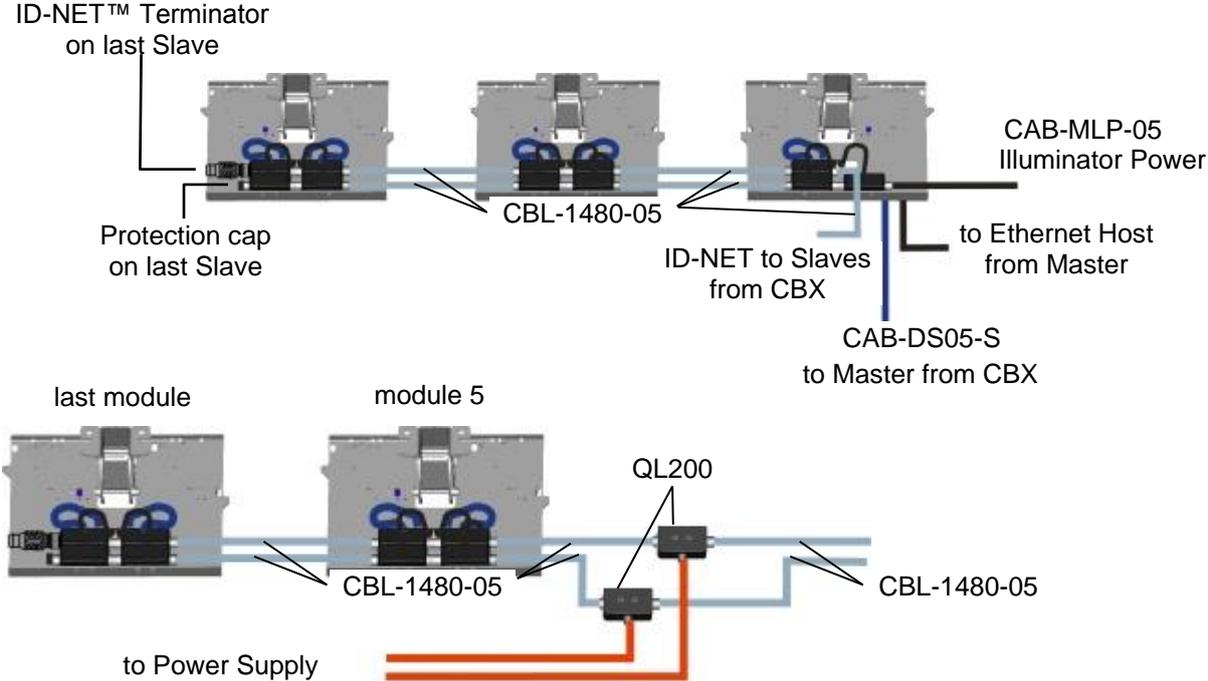


Figure 15 – Hxx Multiple Module Electrical Connections (back view)



**NOTE:** The CAB-MLP-05 Illumination Power cable is connected directly to the power supply. Connect the **White** wire to Vdc and **Blue** wire to GND. Connect the cable shield to Earth ground.

## SOFTWARE CONFIGURATION THROUGH DL.CODE

### DEFAULT CONFIGURATION

Each XRF410N model has its own default configuration (job) which is detailed in the tables and notes below. This job is loaded by default and should not be changed or deleted. Necessary modifications should be saved to a new job named for the application.



**NOTE:** If the default job is ever accidentally deleted, backup files (.dlcfg) are provided in the DL.CODE mini-DVD (.zip file or accessory mini-DVD). They are located in the following directory: **DL.CODE 1.x.0\Software\SW Utilities**

- All XRF410Ns are set to Phase Mode. The photocell (presence sensor) must be connected to Input 1.

The following table shows the **Image Setup** (photometric) parameters settings to use for each model based on the reference application (conveyor speed and code resolution) The Image Setup parameters can be modified if your application references are different.

XRF410N Model	Typical Application Characteristics		Image Setup				
	1D Code Resolution	Conveyor Speed [m/s]	Exposure Time [μs]	Gain	Gain Multiplier	Internal Lighting	PPI
XRF410N-B0x Medium Res	0.38mm (15mils)	1.2	310	29	X1	Very High Power Strobe	91
XRF410N-B1x High Res	0.33mm (13mils)	1	320	36	X1	Very High Power Strobe	111
XRF410N-H0x Medium Res	0.38mm (15mils)	2.2	170	25	X1	Very High Power Strobe	91
XRF410N-H1x High Res	0.33mm (13mils)	1.8	160	35	X1	Very High Power Strobe	111
XRF410N-H2x Very High Res	0.25mm (10mils)	1.5	160	19	X1	Very High Power Strobe	147

Table 2 - Default Image Setup Configuration

In the **Reading Phase** step, set Acquisition Trigger Type to **Periodic**. The period to set depends on the application speed, the maximum code length, and the maximum pack height. To guarantee application functioning, two successive acquisitions must have an overlapping area in the direction of movement at least equal to the maximum code length.

XRF410N Model	Code Setup			Processing Mode	Reading-Phase		
	General Settings		Decoding Strategy		Image Buffer Size	Acquisition Trigger Type: Periodic [ms]	Delay on Internal Trigger [ $\mu$ s] <sup>2</sup>
Decoding Timeout Value [ms] <sup>1</sup>	Code Search Strategy	Decoding Strategy		Image Buffer Size			
XRF410N-B0x Medium res	130	Fast	Fast	Standard	20	45	Master = 0 Slave = 2000
XRF410N-B1x High res	130	Fast	Fast	Standard	20	35	Master = 0 Slave = 2000
XRF410N-H0x Medium res	160	Fast	Fast	Standard	20	60	Master = 0 Slave = 2000
XRF410N-H1x High res	160	Fast	Fast	Standard	20	60	Master = 0 Slave = 2000
XRF410N-H2x Very High res	160	Fast	Fast	Standard	20	60	Master = 0 Slave = 2000

**Table 3 - Default Code Setup and Reading Phase Configuration**

**Note 1:** Decoding Timeout

The Decoding Timeout default values are set based on a statistical analysis of decoding times measured on a variety of packs considered typical in various T&L applications. Decoding Timeout depends heavily on the type of acquired images. As a general rule it is suggested to set a value about equal to three times the Acquisition Period.

In case an application has difficulty decoding with the default values, it is possible to adapt the timeout setting, particularly for applications where the objects are homogenous.

For example in the case of very “noisy” objects (i.e. writing, repetitive patterns or reflections present in the area of the code) it is suggested to limit the Decoding Timeout value to two times the Acquisition Period, and possibly increase the frame rate to have some image redundancy.

**Note 2:** Delay on internal Trigger

In case of multiple XRF410Ns installed next to each other, it is necessary to set an Acquisition Trigger Delay between adjacent readers to avoid overexposure due to simultaneous illumination in the FOV.

In these conditions, for a TOP application it is suggested to set a 2 ms delay for all odd readers in the network while leaving the Master and all even Slaves without a delay (0 ms).

In TOP-SIDE installations it is left to the installer to set the correct delay to avoid simultaneous illumination in the FOV from more than one reader.



## **PACKTRACK CONFIGURATION**

PackTrack applications have the same requirements and considerations as mentioned above for Phase Mode. They also require an Encoder to register line speed (conveyor).

In addition the PackTrack calibration procedure must be executed in DL.CODE. See the DL.CODE User's Manual in the DL.CODE Help menu.