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警示事项

● 感谢您选用辽宁英菲力尔电气自动化科技有限公司的智能化电机软起动器产品，我们将以优异的产品性能与质量回报您的厚爱。

● 在本软起动产品的安装、使用、维护过程中必须注意以下事项：

安装前请务必详细阅读本操作说明。

必须由专业技术人员安装本软起动器。

必须让电动机的规格与本软起动器相匹配。

严禁在软起动器输出端（U.V.W）接电容器。

安装后裸露的接线端子必须用绝缘胶带包好。

软起动器或相关的其他设备应可靠接地。

设备维修时必须切断输入电源。

不得私自拆卸、改装、维修本产品。

智能化软起动器辽宁英菲力尔电气自动化科技有限公司

1、INFR7000 系列软起动概况

INFR7000 系列智能化数字式电机软启动器，采用智能化数字式控制；以单片机位智能中心，可控硅模块为执行元件对电动机进行全自动控制。它适用各种负载的鼠笼型异步电动机控制，使电动机在任何工作状况下均能平滑起动，保护拖动系统，减少起动电流对电网冲击，保证电动机可靠起动。平滑减速停车软停车功能有效地解决了惯性系统的停车喘振问题，消除拖动系统得反惯性冲击，是传统设备无法实现的。INFR7000 系列智能化数字式电机软起动器具有完整的系统保护功能，延长系统的使用寿命、降低系统造价成本、提高系统的可靠性且兼容了所有起动设备的各种功能；是传统星 / 三角起动、自耦减压起动等最理想得新替代产品。

1.1   INFR7000 系列软起动的主要作用

◇ 第一：有效降低了电动机的起动电流；可减少配电容量，避免电网增容投资。
◇ 第二：减小了电动机及负载设备的起动应力；延长了电动机及相关设备的使用寿命。
◇ 第三：软停机功能有效地解决了惯性系统的停车喘振问题；是传统起动设备无法实现的。
◇ 第四：具有六种独特的起动模式；以适应复杂的电机和负载情况，达到完美的起动效果。
◇ 第五：具有完善可靠的保护功能；有效地保护了电动机及相关生产设备的使用安全。
◇ 第六：电动机软起动器智能化、网络化技术的应用使电机控制技术适应了飞速发展的电力自动化技术的更高要求。

1.2   INFR7000 系列软起动的主要特点

◆ 可靠的质量保证：
◇ 采用计算机模拟设计；
◇ SMT 贴片生产工艺；
◇ 优异的电磁兼容性能；
◇ 整机出厂前的高温老化，振动试验。
◆ 完善可靠的系统保护功能：
◇ 失压、欠压、过压保护；
◇ 软起动器过热、起动时间过长保护；
◇ 输入缺相、输出缺相、三相不平衡保护；
◇ 起动过流、运行过载、负载短路保护。

◆ **维护功能：**

◇ 故障自诊断（短路、过电压、单相接地、电机过载、断相、堵转、加上智能程序可研判拖动系统工作状态）；

◇ 模块化组合设计、根据故障显示内容、快速排除故障。

◆ **自主知识产权的产品：**

◇ 专有的电机起动和保护技术；

◇ 独有的检测调试设备和工艺。

◆ **迅捷周到的售后服务：**

◇ 可靠的性能和质量奠定优质服务的基础；

◇ 提供优秀完善的配套设计方案；

◇ 及时周到的使用咨询；

◇ 根据用户意见不断提高产品性能。

2、产品型号说明与开箱检查

每台 INFR7000 系列软起动器出厂前均进行严格的检验和性能测试。用户在收到产品并拆封后，请按下列步骤检查，如发现问题，请及时与供应商联系。

◆ 开箱检查步骤：

◇ 检查产品型号：核对产品外壳上的规格标牌，确认您收到的货物与您订购的产品是否相符。

```
INFR  － □ － □ / □
                   └── 适 用 电 压：3表示AC380VS

                └────── 适 用 电 机：如505表示电机的额
                                      定功率是5.5KW

           └─────────── 设 计 序 号：6000表示数字显示
                                      7000表示中文显示

   └──────────────────── 产 品 命 名：INFR系列软起动器
```
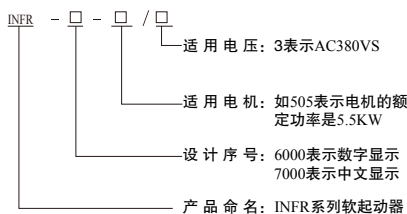
◇ 检查产品是否在运输过程中受到损伤，如：内部零件脱落有异常响动、外壳开裂、变形等。

◇ 检查其他物品：每台软起动器包装箱内除了产品本身外，还应有配套的产品检验合格证及操作说明各一份。

3、使用条件与安装要求

INFR7000 系列软起动器应符合下述使用条件与安装方法要求；否则，性能将不予保证，严重时甚至会造成软起动器寿命缩短直至损坏。

3.1　软起动器的使用条件

◇　供电电源：市电、自备电站、柴油发电机组三相交流 380V ± 15%.50Hz 或 60HZ, 电源容量必须满足软起动器对电动机的起动要求。

◇　适用电机：鼠笼式三相异步电动机，电机额定功率应与软起动器额定功率匹配。

◇　起动频度：没有要求，具体次数视负载情况而定。

◇　冷却方式：自然风冷。

◇　防护等级：IP20

◇　环境条件：海拔 3000 米以下，环境温度 ~ 25℃ ~ +40℃ 之间，相对湿度 90%RH 以下，无凝露，无易燃、易爆、易腐蚀性气体，无导电性尘埃，室内通风良好、震动小于 0.5G 的地方。

◇　本公司可为用户提供在特殊条件下使用的产品，如防爆型、低温型、高压型软起动器，其使用条件另行说明。

3.2　外形与安装尺寸

软起动型号及规格	额定功率（KW）	额定电流（A）	外型尺寸			安装尺寸			净重（Kg）
			H1	W1	D	H2	W2	安装螺丝孔	
INFR7000 -505/3	5.5	11	270	146	160	251	132	M6	< 5
INFR7000 -705/3	7.5	15	270	146	160	251	132	M6	< 5
INFR7000 -11/3	11	23	270	146	160	251	132	M6	< 5
INFR7000 -15/3	15	30	270	146	160	251	132	M6	< 5
INFR7000 -1805/3	18.5	37	270	146	160	251	132	M6	< 5
INFR7000 -22/3	22	43	270	146	160	251	132	M6	< 5
INFR7000 -30/3	30	60	270	146	160	251	132	M6	< 5
INFR7000 -37/3	37	75	270	146	160	251	132	M6	< 5
INFR7000 -45/3	45	90	270	146	160	251	132	M6	< 5
INFR7000 -55/3	55	110	270	146	160	251	132	M6	< 5
INFR7000 -75/3	75	150	270	146	160	251	132	M6	< 5
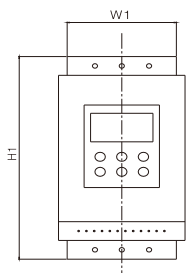
适用电机 5.5KW ～ 55KW 外型尺寸图   安装孔示意图
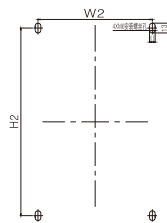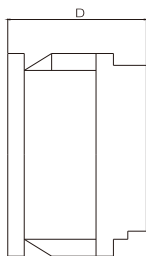
软起动型号及规格	额定功率（KW）	额定电流（A）	外型尺寸			安装尺寸			净重（Kg）
			H1	W1	D	H2	W2	安装螺丝孔	
INFR7000 -75/3	75	150	535	260	195	380	195	M8	< 23
INFR7000 -90/3	90	180	535	260	195	380	195	M8	< 23
INFR7000 -115/3	115	230	535	260	195	380	195	M8	< 23
INFR7000 -132/3	132	260	535	260	195	380	195	M8	< 23
INFR7000 -160/3	160	320	535	260	195	380	195	M8	< 23
INFR7000 -185/3	185	370	535	260	195	380	195	M8	< 23
INFR7000 -200/3	200	400	535	260	195	380	195	M8	< 23
INFR7000 -250/3	250	500	560	290	200	410	260	M8	< 31
INFR7000 -280/3	280	560	560	290	200	410	260	M8	< 31
INFR7000 -320/3	320	640	560	290	200	410	260	M8	< 31
INFR7000 -400/3	400	800	590	330	250	500	300	M8	< 31
INFR7000 -450/3	450	900	590	330	250	500	300	M8	< 31
INFR7000 -500/3	500	1000	660	410	250	550	370	M8	< 40
INFR7000 -600/3	600	1200	660	410	250	550	370	M8	< 40

适用电机 75KW ～ 600KW 外型尺寸图　　　　安装孔示意图
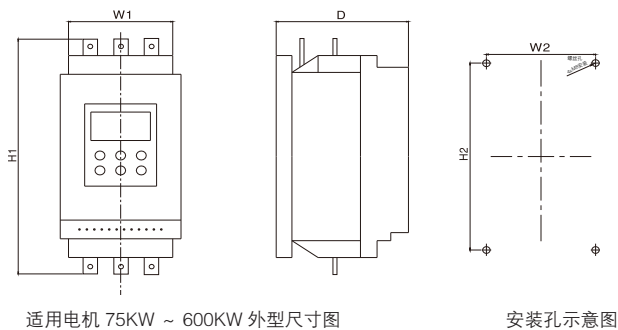
3.3　INFR7000 系列软起动器的安装实图

注：输出继电器触点容量 AC 250V 5A

4、软起动器外接端说明

外接端子如图 4.2 所示：

旁路输出　编程输出　故障输出　瞬停　停止　起动　公共　DC0~20mA 输出
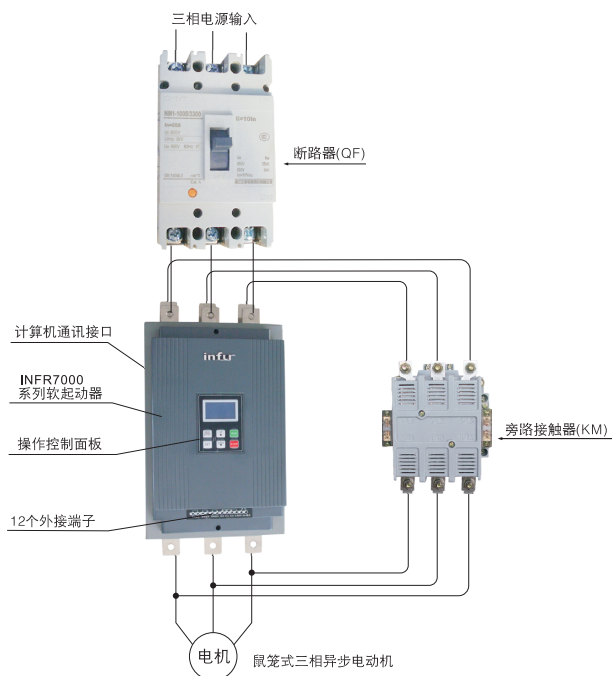
图 4.2

端子序号	端子名称	说明
1 2	旁路输出	用于控制旁路接触器，为常开无源触点，起动成功时闭合。
3 4	可编程继电输出	输出方式功能由设置码FE设定，为常开无源触点。触点容量为AC250V/5A。
5 6	故障输出	软起动器发生故障或失电时闭合，工作正常时开路，为无源触点。触点容量为：AC250V/0.5A
7	瞬停输入	软起动器正常工作时此端子必须与端子10短接。若此端子与端子10开路时，软起动器无条件停止工作，处于故障保护状态。此端可受控于外部保护装置的常闭输出点。设置码FA设为0(初级保护)时，此端子功能被禁止。
8 9 10	外控起动、停止按钮输入	有两种接法，即三线方式和二线方式。可根据需要选择连接
11 12	直流模拟输出	用于实时监视电机电流，满度20mA时指示电机电流为软起动器标称额定电流的4倍，可外接0~20mA直流电流表观察，该输出负载电阻最大值为300Ω。

3 线方式

2 线方式　K 闭合则起动
K 断开则停止
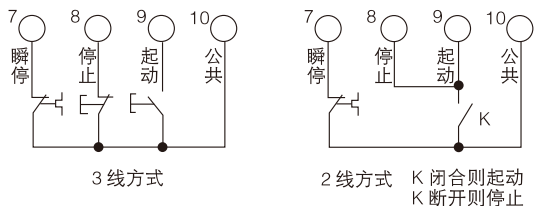
◆　外接端子线切勿接错，否则有可能导致本软起动器损坏。

4.1　INFR7000 系列软起动器主回路接线简图
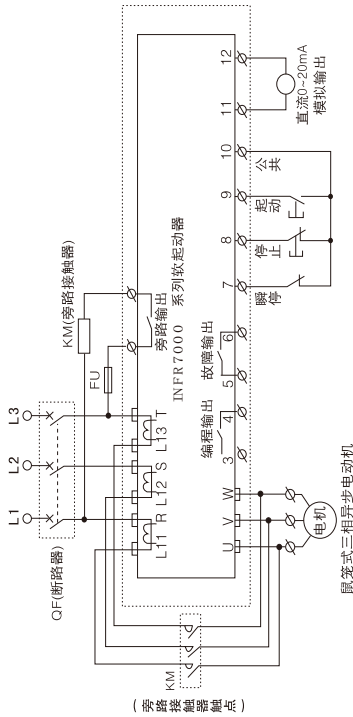
图 4.4

注：○ 55KW 及以下规格的软起动器出厂时标准配置为三进三出型，即无运行监测
　　　保护功能；亦可按用户要求配置成六进三出型。六个输入铜排中，上面三
　　　个接断路器，下面三个接旁路接触器。

　　○ 1 和 2 控制旁路接触器的接点是无源继电器输出点；7 接点断开为瞬停输入；
　　　8 接点断开为软停；9 接点通为软起；10 接点为公共端；3 或 4 接点为时
　　　间继电器接点与软起同步延时；软起动器内置短路保护和过载保护；7 接点
　　　瞬停自复位可编程；控制模式限流型和电压斜坡型，任意自选；11、12 为
　　　0 ～ 20mA 模拟信号输出；

4.2　通迅接口与说明

◆　INFR7000 系列软起动器在供货时配有计算机
通讯接口：

◇　RJ–45 插座为标准网线插座。

◇　DB9 插座内置 RS485 和 RS232 接口，其引脚说明如下：

其中：①为 RS485+

　　　　⑥为 RS485–

　　　　②为 RS232 输出

　　　　③为 RS232 输入

　　　　④为 +5V 输出

　　　　（限流 50mA）

　　　　⑤为地 GND

　　　　⑦⑧⑨空

DB9插座：
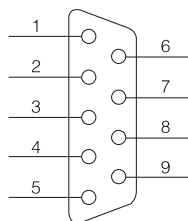
图 4.5

◆　产品出厂时已自带 RS232 与 RS485 接口，用户可按不同的需求，选购以下选件：

◇　计算机集散式控制通讯软件

◇　DeviceNet 接口卡及通讯软件

◇　DeviceNet/Modbus/Profibus 网关

◇　集群用户提出的其他配置要求

5、控制面板与操作

INFR7000 系列软起动器有 5 种工作状态：准备、运行、故障、起动和停止。准备、运行、故障均有相应的状态指示灯，起动时显示 ˉXXXX，软停时显示 _XXXX，其中 XXXX 表示电机电流。

5.1　键盘操作方法

◆ 开机状态：只有在准备指示灯亮且显示英菲力尔科技或 READY 时按起动键才可起动电机。初次上电时显示英菲力尔科技，否则显示 REDAY 表示准备。

◆ 延时状态：准备或故障状态指示灯闪动表示间隔延时；显示 dEXXX 且倒计时表示起动延时。

◇ 起动 RUN 和停止 STOP 键：在软起过程中，显示器显示 ˉXXXX，指示起动电流值，此时只有停止 STOP 键起作用，不能进入设置和帮助提示菜单，同时准备、运行、故障三个指示灯均不亮。在软停过程中，显示器显示 _XXXX，指示电机电流值，此时只有起动 RUN 键起作用，不能进入设置和帮助提示菜单，同时准备、运行、故障三个指示灯均不亮。停止 STOP 键兼有复位故障状态的功能。

◇ 设置 SET 键：在非帮助状态下，按设置 SET 键进入设置菜单，显示 PX:XXX；再按设置 SET 键，冒号闪动，表示可以修改冒号后面的参数。在冒号闪动时按确认 ENTER 键，若数据已被修改，则显示 good，并连响两声，表示新数据已被保存，然后退出。若不想保存新数据，则按设置 SET 键，冒号停止闪动同时恢复原来的数据，再按确认 ENTER 键退出。也可按停止 STOP 键全键直接退出。

◇ 确认 ENTER 键：在非设置状态下，按确认 ENTER 键进入帮助菜单，显示 HX：XXX，再按确认 ENTER 键退出。也可按停止 STOP 键退出。在设置状态下，按确认 ENTER 键保存新数据并退出设置状态。

◇ 向上 UP、向下 DOWN 键：在设置菜单中，冒号不闪时按向上 UP 或向下 DOWN 键可改变功能号；冒号闪动时按向上 UP 或向下 DOWN 键则改变数据，按住向上 UP、向下 DOWN 键超过 1 秒时，数据将快速连续增减。在帮助菜单中按向上 UP 或向下 DOWN 键改变功能号及相应的提示信息内容。在旁路运行

指示灯亮时，且未进入设置和帮助菜单，则显示 XXXXA，表示电机运行电流，此时按向上 UP 或向下 DOWN 键，可依次选择显示 PXXXX 或 HXXXX。其中 PXXXX 表示电机视在功率；HXXXX 表示电机过载热平衡系数，当 HXXXX 指示值大于 100% 时，将过载保护，显示 Err08。

◇ 当数据大于 999 时，最后一位小数点亮，表示尾数 + 0。

◇ 按键操作有效时将有声响提示，否则说明本状态下此键无效。

◇ 外控端子接于 3 线方式时，外控起动按钮和停止按钮分别与控制面板上的起动 RUN 键和停止 STOP 键功能等效。

◇ 控制面板采用超强抗干扰设计，允许外引距离大于 3 米

5.2　参数设置与说明

中文显示参数设置代码如下表：

表 5.1

设置代码说明				
代码	名称	设定范围	出厂值	说明
F0	起始电压	30-70%	30%	电压斜坡模式有效；电流模式起始电压为40%
F1	软起时间	2-60S	16S	限流模式无效。
F2	软停时间	0-60S	0S	设为0时自由停车；一拖二接线时请设为0。
F3	起动延时	0-999S	0S	用倒计时方式延时，设为0时不延时，立即起动。
F4	编程延时	0-999S	0S	用于可编程继电输出。
F5	起动限制电流	50-500%	280%	限流模式有效；电压斜坡模式限流值最大为400%
F6	最大工作电流	50-200%	100%	电机额定电流的百分比。
F7	欠压保护	40-90%	80%	低于设定值时保护。
F8	过压保护	100-140%	120%	高于设定值时保护。
F9	起动模式	0-5	1	0限流；1电压；2突跳限流；3突跳+电压；4电流斜坡；5双闭环。
FA	输出保护允许	0-4	4	0初级；1轻载；2标准；3重载；4高级。
FB	操作控制方式	0-6	1	0键盘，1键盘+外控，2外控，3、外控+通讯，4、键盘+外控+通讯，5、键盘+通信，6、通信
FC	参数修改允许	0-2	1	详见说明P16

FD	通讯地址	0-63	0	用于多台软起动器与上位机多机通讯。
FE	编程输出	0-19	7	运行继电器输出(03、04端子)设备
FF	软停限流	20-100%	80%	详见说明P27
FP	电机额定电流		额定值	用于输入电机标称额定电流。
FU	电机欠载保护			说见页说明P16

备注：　1、设置项F6最大工作电流是指允许电机在FP设置数基础上计算的可持续运行
　　　　　的最大电流，此值将做反时限热保护。
　　　　2、设置状态下若超过2分钟没有按键操作，将自动退出设置状态。
　　　　3、在软起和软停过程中不能设置参数，其他状态下均可设置参数。

5.3　可编程继电输出功能

可编程继电输出功能有两种工作方式,既可编程时序输出方式和可编程状态输出方式。

◆　设置项 FE 为 0 ~ 4(10 ~ 14) 时，可编程输出工作于时序输出方式，设定输出的起始时刻如下表：

表 5.2

FE设置的数值	0(10)	1(11)	2(12)	3(13)	4(14)
编程输出时刻	发起动命令时	开始起动时	旁路运行时	发停止命令时	停机完成时

◇　此工作方式包含一个 999 秒定时器，自设置项 F4 设定。若 F4 不为 0，则按设置项 FE 设定的起始时刻开始计时,计时到则输出改变状态，若设置项 F4 为 0则立即改变输出状态。该输出的复位时刻是在按 F4 设置时间延时结束且在准备状态下再维持 1 秒时。

◇　可编程时序输出方式是以一次起动过程为控制周期的，如果再次起动电机则自动中断上次编程输出过程并重新启动该过程。

◆　设置项 FE 为 5 ~ 9(15–19) 时，可编程输出工作于状态输出方式，设定的工作状态输出如下表：

表 5.3

FE设置的数值	5(15)	6(15)	7(17)	8(17)	9(19)
输出指示状态	故障状态	运行状态	准备状态	起动状态	旁路状态

◇　可编程状态输出方式用于指示软起动器的工作状态,此方式下设置项 F4 设置的时间无效。设置项 FE 出厂值为 7，即指示软起动器的准备工作状态，此状态下可起动电机；可编程输出为故障状态时，是指电机类故障（ Err05、Err06、Err07、Err08、Err12、Err15 ），它不同于⑤、⑥号故障输出端子的功能；运行状态是指非准备或故障状态，它包括起动、旁路、软停三个过程。

◇　当 FE > 9 时，可编程输出（③、④号外接端子）的复位状态由常开变为闭合，即反相输出。灵活运用可编程继电器输出功能,可有效地简化外围控制逻辑线路。

5.4 其它设置项说明

◆ 设置项 FB 用于选择电机起动控制方式，如下表：

表 5.4

数值	0	1	2	3	4	5	6	7
键盘	1	1	0	0	1	1	0	0
外控	0	1	1	1	1	0	0	0
通信	0	0	0	1	1	1	1	0

◇ 表中 1 为允许，0 为禁止。例如若起动后不允许意外停止，或维修时不允许意外起动，可把此项设为 7，则禁止所有起动或停止操作。

◇ 当外控允许时，外控端子⑧、⑩之间必须接一常闭按钮开关或短接，否则无法起动电机。

◆ 设置项 FC 为参数修改允许选择项，有三种选择：

◇ 设置项 FC 为 0 时，除设置项 FC，禁止修改任何参数。

◇ 设置项 FC 为 1 时，禁止修改设置项 F4、F6、F8、FD、FE、FF、FU 的数值。

◇ 设置项 FC 为 2 时，允许修改所有设置项的数据。

◆ 设置项 FU 用于设定电机欠载保护功能。

◇ 设置项 FU < 10 时，禁止电机欠载保护功能。

◇ 欠载保护电流范围为电机额定电流的 10% ～ 90%；由设置项 FU 的十位数确定。

◇ 欠载保护延时范围为 5 ～ 90 秒，由设置项 FU 的个位数乘以 10 确定，当 FU 的个位数为 0 时，保护动作延时为 5 秒。例如设置项 FU=42，则表示欠载电流为 40%。保护动作延时为 20 秒。

5.5　帮助信息及说明

帮助信息提示如下表：

显示	说明
AC:XXX	3位数字电压表，用于监测三相交流电源电压。
055-3	提示本软起动器规格为55KW-380/50Hz。
H1:E05	提示最后发生过的故障信息Err05。
H2:E01	提示曾发生过的故障信息Err01。
H3:E06	提示曾发生过的故障信息Err06。
H9:E00	提示没有故障信息。
VER3.0	提示本产品软件版本为VER3.0。
LXXXX	成功起动次数总计。
RUNXX	上次软起动（不论是否成功）所用时间。
注：H1～H9用递推的方式储存新近发生过的9个帮障信息。	

◇ 在非软起和软停状态，且未进入设置状态时，按确认键可进入帮助菜单，再按
　向上、向下键可选择提示信息。

◇ 在帮助状态下按确认键或停止键可退出帮助状态。

6、保护功能与说明

◆ INFR7000 系列软起动器具有完善的保护功能以保护软起动器和电动机的使用安全。在使用中，应根据不同情况恰当设置保护级别和保护参数。

6.1 保护功能及其参数

◇ 软起动器过热保护：温度升到 80℃ ±5℃时保护动作，当温度降至 55℃时(最低)，过热保护解除。

◇ 输入缺相保护滞后时间 ：< 3 秒。

◇ 输出缺相保护滞后时间 ：< 3 秒。

◇ 三相不平衡保护滞后时间 ：< 3 秒。以各相电流偏差大于 50% ± 10% 为基准，当负载电流低于软起动器标称额定值的 30% 时，判定基准偏差将增大。

◇ 起动过流保护时间：持续大于设置项 F6 最大工作电流 5 倍时的保护时间见表 6.1。

◇ 运行过载保护时间 ：以设置项 F6 最大工作电流为基准作反时限热保护，脱扣保护时间曲线如图 6.1。

◇ 电源电压过低保护滞后时间：当电源电压低于极限值 40% 时，保护动作时间 < 0.5 秒，否则低于设定值时保护动作时间 < 3 秒。

◇ 电源电压过高保护滞后时间：当电源电压高于极限值 140%，保护工作时间 < 0.5 秒 ；否则高于设定值时保护动作时间 < 3 秒。

◇ 负载短路保护滞后时间 ：< 0.1 秒，电流为软起动器标称额定电流的 10 倍以上。本保护不能替代熔断器保护装置。

◇ 电机欠载保护 ：电流范围为电机额定电流的 10% ～ 90%，保护动作延时为 5 ～ 90 秒。

◆ 以上时间参数是从检测到有效信号开始到发出脱扣保护指令为止，参数仅供参考。INFR7000 系列软起动器所列的所有保护功能均可通过实际的或模拟的方法进行验证，若不符合用户的要求，则应另加专用保护装置，以确保安全。

6.2 保护级别设定说明

◆ 为了适应不同的应用场合，INFR7000 系列软起动器设有五个保护级别，分别为 0 初级、1 ：轻载、2 ：标准、3 ：重载、4 ：高级，由设置项 FA 设定，其中

◇ 初级保护禁止了外接瞬停端子功能，同时仅保留了过热、短路和主回路故障保护，适用于需无条件紧急起动的场合，如消防系统等。

◇ 轻载、标准、重载三个保护级别具备完的保护功能，区别在于电机过载热保护时间曲线不同。其电机热保护时间参数见表 6.1 和图 6.1。

◇ 高级保护在起动时的保护标准更为严格，其他保护功能参数与标准保护设置相同。

◆ 按设置项 FA 设定的不同保护级别及热保护时间如下表 ：

表 6.1

FA设置	0 （初级）	1 （轻载）		2 （标准）			3 （重载）			4 （高级）			说明
运行过载保护级别	无	2级		10级			20级			10级			按IEC60947-4-2标准
起动过流保护时间	无	3秒		15秒			30秒			15秒			按起动电流超过F6设备5倍设定
运行过载脱扣时间列表	电流倍数(l/le)	3	4	5	3	4	5	3	4	5	3	4	5	表中数值为典型值
	脱扣时间（秒）	4.5	2.3	1.5	2.3	12	7.5	46	23	15	23	12	7	

◇　应按电机标牌上的额定电流数值输入设置项 FP，否则当设置项 F5、F6 的输入方式为百分比方式（由设置项设定）时，起动电流和保护电流会有较大偏差。

◇　设置项 FP 设定的电机电流不能低于软起动器标称电流的 20%。当 FP 设定的电机电流较小时，保护脱扣动作的灵敏度误差将增大。

按 IEC60947−4−2 标准的电机热保护脱护时间曲线如下：
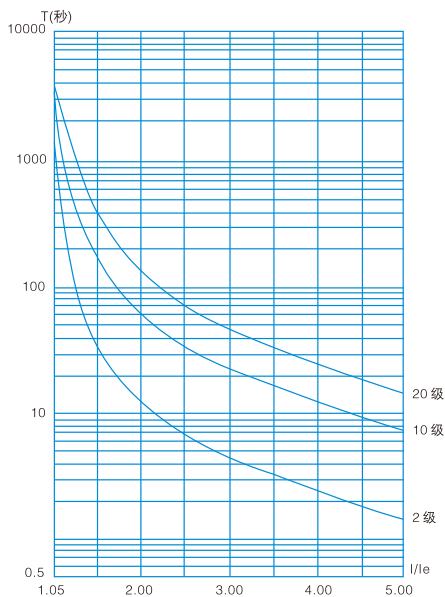
电机热保护脱扣时间曲线(热状态)

图 6.1

7、试运行与应用

◆ 通电运行前应按下列条款仔细检查：

◇ 软起动器额定功率是否与电动机相匹配。

◇ 电动机绝缘性能是否符合要求。

◇ 输入输出主回路接线是否正确。

◇ 所有接线端子的螺丝是否拧紧

7.1 通电试运行

◇ 上电时按 STOP 显示英菲力尔科技 READY（准备），且准备状态指示灯亮，此时按起动键可起动电机。

◇ 按电机标牌上的额定电流数值输入设置项 FP。

◇ 起动后检查电机转动方向是否正确，运转是否正常，若不正常，可按停止键停机或必要时切断电源。

◇ 如果电机起动状态不理想，可参考 P23 页 7.2 软起动器的起动模式及应用一节选择恰当的起动模式。

◇ 若电动机起动力矩不够，可改变起始电压（电压方式时）或限流值（电流方式时），提高电动机起动转矩。

◇ 软起动器通电后，请勿打开上盖，以免触电。

◇ 在通电试运行过程中，如发现异常现象，如异常声音、冒烟或异味等，应迅速切断电源并查清原因。

◇ 若上电后或起动时故障指示灯亮且显示 ErrXX，可按所显示的故障代码对应 P22 页查找原因。

◆ 按停止键或外控停止按钮可复位故障状态。

◆ 注意：当环境温度低于 –10℃时，应通电预热 30 分钟以上再起动。

故障代码及处理方法如下表：

显示	说明	问题及处理方法
ERR00	故障已解除	刚发生过欠压、过压或过热、瞬停端子开路等故障，现已正常，此时准备灯亮，复位后可起动电机。
ERR01	外接瞬停端子开路	把外接瞬停端子⑦与公共端子⑩端路连接，或接于其它保护装置的常闭触点。
ERR02	软起动器过热	起动过于频繁或电机功率与软起动器不匹配
ERR03	起动时间过长大于60秒	起动参数设置不合适或负载太重、电源容量不足等。
ERR04	输入缺相	检查输入或主回路故障、旁路接触器是否卡在闭合位置及可控硅是否开路等。

ERR05	输出缺相	检查输出或主回路故障、旁路接触器是否卡在闭合位置及可控硅是否短路等。
ERR06	三相不平衡	检查输入三相电源及负载电机是否异常。
ERR07	起动过流	负载是否过重或电机功率与软起动器不匹配。
ERR08	运行过载保护	负载是否过重或设置项F6、FP参数设置不当。
ERR09	电源电压过低	检查输入电源电压或设置项F7参数设置不当。
ERR10	电源电压过高	检查输入电源电压或设置项过压保护参数设置不当。
ERR11	设置参数出错	修改设置或按着确认键上电开机恢复出厂值。
ERR12	负载短路	检查负载或可控硅是否短路或负载过大。
ERR13	自动重起动接线错误	检查外控起动与停止端子是否未接于2线方式。
ERR14	外控停止端子接线错误	当允许外控方式时，外控停止端子处于开路状态，从而无法起动电机。
ERR15	电机欠载	检查电机主轴及负载故障。
备注：有些故障现象是相互关联的，如报告Err02软起动器过热时和起动过流或负载短路等有可能相关，因此，查故障时，应综合全面考虑，准确判断故障点。			

注意：当软起动器起动电机成功时，面板中间的运行状态指示灯点亮，表示已处于旁路运行状态。若此时旁路接触器未吸合导致电机停止运行时，应检查旁路接触器及相关接线是否有误或接触不良。

7.2　INFR7000 系列软起动器的起动模式及应用

INFR7000 系列软起动器有六种起动模式以适应各种复杂的电机和负载情况，用户可根据不同的应用情况进行选择。

7.2.1　限电流起动模式：

设置项 F9 为 0 时设定起动模式为此模式。

图 7.1 给出了限电流起动模式的电机电流变化波形。其中 II 为设定的起动限流值，当电机起动时，输出电压迅速增加，直到电机电流达到设定的限流值 II，并保持电机电流不大于该值，然后随着输出电压的逐渐升高，电机逐渐加速，当电机达到额定转速时，旁路接触器吸合，输出电流迅速下降至电机额定电流 Ie 或以下，起动过程完成。

当电机负载较轻或设定的限流值较大时，起动时的最大电流也可能达不到设定的限流值时属正常。

限电流起动模式一般用于对起动电流有严格限制要求的场合。
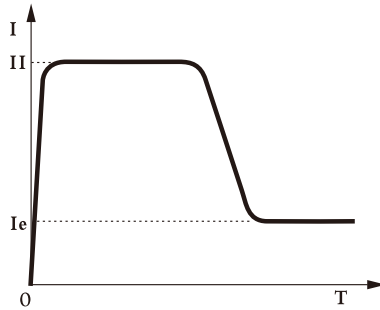
图 7.1

7.2.2 电压斜坡起动模式

设置项 F9 为 1 时设定起动模式为此模式。

图 7.2 给出了电压斜坡起动的输出电压波形。其中 U1 为起动时的初始电压值，当电机起动时，在电机电流不超过额定值 400% 的范围内，软起动器的输出电压迅速上升至 U1，然后输出电压按所设定的起动参数逐渐上升，电机随着电压的上升不断平稳加速，当电压达到额定电压 Ue 时，电机达到额定转速，旁路接触器吸合，起动过程完成。

起动时间 t 是根据标准负载在标准实验条件下所得的控制参数，INFR7000 系列软起动器以此参数为基准，通过控制输出电压使电机平稳加速以完成起动过程，并非机械地控制时间 t 而不论电机加速是否平稳。鉴于此，在负载较轻时，起动时间往往小于设定的起动时间，只要能顺利起动则属正常。

一般而言，电压斜坡起动模式适用于对起动电流要求不严而对起动平稳性要求较高的场合。
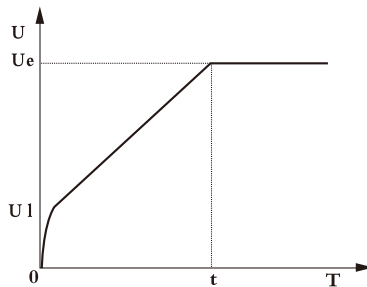
图 7.2

7.2.3 突跳起动模式：

设置项 F9 为 2 或 3 时设定起动模式为此模式。

图 7.3 和图 7.4 给出了突跳起动模式的输出变化波形。在某些重载场合下，由于机械静摩擦力的影响而不能起动电机时，可选用此种起动模式。在起动时，先对电机施加一个较高的固定电压并持续有限的一段时间，以克服电机负载的静摩擦力使电机转动，然后按限电流（图 7.3）或电压斜坡（图 7.4）的方式起动。

在用此模式前，应先用非突跳模式起动电机，若电机因静摩擦力太大不能转动时，再选用此模式；否则应避免采用此模式起动，以减少不必要的大电流冲击。
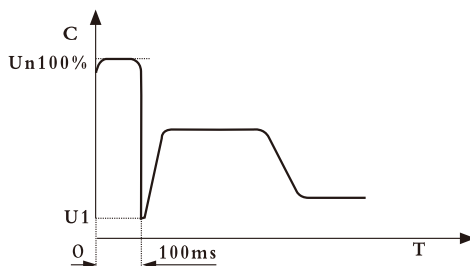
图 7.3
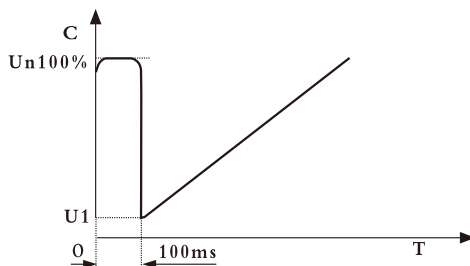
图 7.4

7.2.4 电流斜坡起动模式：

设置项 F9 为 4 时设定起动模式为此模式。

图 7.5 为电流斜坡起动模式的检出电流波形，其中 II 为 F6 设置的限流值，T1 为 F1 设置的时间值。

电流斜坡起动模式具有较强的加速能力，适用于两极电机，也可在一定范围内缩短起动时间。
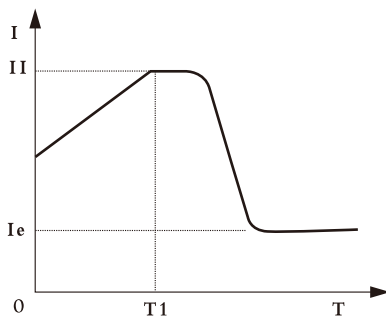
图 7.5

7.2.5 电压限流双闭环起动模式：

设置项 F9 为 5 时设定起动模式为此模式。

电压限流双闭环起动模式采用电压斜坡和限电流双闭环回路控制，是一种既要求起动较平稳又要求严格限流的综合起动模式，它采用了估算电机工作状态的预测算法。该起动模式的输出电压波形将根据电机和负载情况的不同而有所变化。

7.3 INFR7000 系列软起动器的停机模式及应用

INFR7000 系列软起动器有两种停机模式，即软停机模式和自由停机模式。

7.3.1 软停机模式：

设置项 F2 不为 0 时设定停机模式为此模式。

在这种停机模式下，电动机的供电由旁路接触器切换到软起动器的晶闸管输出，软起动器的输出电压由全压开始逐渐减小，使电机转速平稳降低，以避免机械震荡，直到电机停止运行。软停机时的输出载止电压等同于起动时的起始电压。

软停机模式可减少和消除水泵类负载的喘振。

◇ 软停机模式可用设置项 FF 设定软停限流值，减少软停时的大电流冲击，注意此软停限流值是在起动限流值基础上计算的百分比。

7.3.2 自由停机模式：

设置项 F2 为 0 时设定停机模式为此模式。

在这种停机模式下，软起动器接到停止命令后立即断开旁路接触器并禁止软起动器晶闸管的电压输出。电动机依负载惯性逐渐停机。在一拖二（多）接线方式时，应把软起动器的停机模式设为此，以避免输出切换时的缺相故障报告。

一般情况下，如无必要软停机，则应选择自由停机模式，以延长软起动器的使用寿命。

◇ 自由停机模式完全禁止了瞬时输出，可避免特殊应用场合的瞬时大电流冲击。

7.4　特殊应用

◆ 并联电机的起动：

◇ 如果不超过软起动器的额定功率限制，电机可以并联连接（电机电流的总和不能超过根据应用类型选定的软起动器的额定电流），但此时应另外提供对每个电机的热保护装置。

◆ 双速电机的起动：

◇ INFR7000 系列软起动器可以配合双速电机起动，在由低速变高速之前必须经过延时去磁期，以避免出现在线路和电机之间产生非常大的反相电流。

◆ 很长的电缆：

◇ 由于电缆的电阻原因，很长的电机电缆会导致电压的降落，如果电压降落十分明显，它将会影响电流损耗和起动转距，在选择电机和软起动器的必须考虑这一点。

◆ 并联在同一条电源线路上的软起动器：

◇ 如果在同一条电源线路上安装了若干个软起动器，则在变压器至软起动器的线路中间应安装进线电抗器。电抗器应安装在每个进线断路器和软起动器之间。

◆ 电涌保护器（SPD）的使用：

◇ 在可能导致雷击或其它原因在应用系统中引起过压、过流、浪涌干扰的场所应考虑安装电涌保护器，详细应用方法请参照《电涌保护器（SPD）》产品样本或其它有关资料。

7.5　应用举例

◆ 各种不同负载情况下的参数设置举例如表 7.2，表中数据仅供参考，应根据实际情况作相应调整。

表 7.2

负载种类	起动时间(秒)	初始电压	电压起动 （最大限流值）	限流起动
球磨机	30	60%	4	4.5
风机	26	30%	4	3.5
离心泵	16	40%	4	2.5
活塞式压缩机	16	40%	4	3
提升机械	16	60%	4	3.5
搅拌机	16	50%	4	3
破碎机	16	50%	4	3.5
螺旋压缩机	16	40%	4	3

传送带	20	40%	4	2
轻载电机	16	30%	4	3
反带运输带	20	40%	4	2.5
热泵	16	40%	4	3

附录一

INFR7000 系列软起动器（5.5KW ~ 75KW）外围配件的规格参数列表供参考：

软动器型号	额定功率（单位：KW）	额定电流（单位：A）	配套的断路器型号（OF）	配套的断路接触器型号（KM）	一次线规格	备注
INFR7000-5.5/3	5.5	11	CM1-63L/16	CJ20-16	2.5mm² 电缆线	55kW及以下接线为三进三出，一般在旁路接触器回路上需加热继电器或点机保护器作运行保护。也可打开上盖，在三个模块的A极引出三条电缆改为六进三出，或在订货时提出六进三出的配置要求，否则无在线保护功能。额定功率和额定电流是指软起动器的最大额定值。
INFR7000-7.5/3	7.5	15	CM1-63L/20	CJ20-16	4mm²电缆线	
INFR7000-11/3	11	23	CM1-63L/32	CJ20-25	6mm²电缆线	
INFR7000-15/3	15	30	CM1-63L/40	CJ20-40	10mm²电缆线	
INFR7000-18.5/3	18.5	37	CM1-63L/50	CJ20-40	10mm²电缆线	
INFR7000-22/3	22	43	CM1-63L/63	CJ20-63	16mm²电缆线	
INFR7000-30/3	30	60	CM1-100L/80	CJ20-63	25mm²电缆线	
INFR7000-37/3	37	75	CM1-100L/100	CJ20-100	25mm²电缆线	
INFR7000-45/3	45	90	CM1-160L/125	CJ20-100	25mm²电缆线	
INFR7000-55/3	55	110	CM1-160L/165	CJ20-160	35mm²电缆线	
INFR7000-75/3	75	150	CM1-225L/180	CJ20-160	35mm²电缆线	

附录一、INFR7000 系列软起动器（75KW~320KW）外围配件的规格参数列表供参考

续表：

软动器型号	额定功率（单位：KW）	额定电流（单位：A）	配套的断路器型号（OF）	配套的断路接触器型号（KM）	一次线规格	备注
INFR7000-75/3	75	150	CM1-225L/180	CJ20-160	30X3mm² 铜排	75kW及以上接线为六进三出，在旁路接触器闭合后仍带在线保护功能，无须外加电机保护装置额定功率和额定电流是指软起动器的最大额定值。配套的断路器和旁路接触器的规格应与电机规格相匹配。
INFR7000-90/3	90	180	CM1-225L/225	CJ20-250	30X3mm² 铜排	
INFR7000-115/3	115	230	CM1-225L/315	CJ20-250	30X3mm² 铜排	
INFR7000-132/3	132	260	CM1-400L/315	CJ20-400	30X4mm² 铜排	
INFR7000-160/3	160	320	CM1-400L/350	CJ20-400	30X4mm² 铜排	
INFR7000-185/3	185	370	CM1-400L/400	CJ20-400	40X4mm² 铜排	
INFR7000-200/3	200	400	CM1-400L/500	CJ20-400	40X4mm² 铜排	
INFR7000-250/3	250	500	CM1-630L/600	0CJ20-630	40X5mm² 铜排	
INFR7000-280/3	280	560	CM1-630L/630	CJ20-630	40X5mm² 铜排	
INFR7000-320/3	320	640	CM1-630L/700	CJ20-630	40X5mm² 铜排	

⚠ Warning Items

● Thanks for applying Intelligent Motor Soft Starter Product of Liaoning INFLR Electric Automation Technology Co., Ltd. We will pay you back with excellent product performance.

● The following items shall be paid attention to during installation, application and maintenance of the soft starter product:

⚠ Please read this operation manual thoroughly before installation.

⚠ The soft starter shall be installed by professional technicians.

⚠ The motor specifications shall be matched to the soft starter.

⚠ Prohibit connecting capacitor at output terminals of soft starter (U, V, W).

⚠ The bare wiring terminals shall be well wrapped with insulating tape after installation.

⚠ The soft starter and other related devices should be grounding reliably.

⚠ Private disassembly, refit and repair of the product are unallowable.

1. Profile of INFLR Series Soft Starter

INFLR series intelligent digital motor soft starter is applied with intelligent digital control; the motor is in full–automatic control with single–chip computer as intelligent center and thyristor modules as execute components. It can be used under various loads for squirrel–cage asynchronous motor control and can start the motor smoothly in any working conditions so as to protect the dragging system, reduce grid impact caused by starting current and insure reliable motor start. Smoothly slow down to stop, the soft–stop function can efficiently solve the stop–surging problem of inertial system and eliminate the anti–inertial impact of dragging system which can not be realized by traditional equipments. INFLR series intelligent digital motor soft starter is equipped with complete system protection function so as to prolong system service life, reduce system construction costs, improve system reliability and be compatible with various functions of all kinds of starting equipments. It's the perfect new substitute product for traditional star/delta starting, autotransformer starting, etc.

1.1   Main Function of INFLR series Soft Starter

◇ I. Efficiently reduces motor starting current, can reduce distribution capacity and avoid grid expansion investment.
◇ II. Reduce starting stress of motor and load equipments, prolong service life of motor and related equipments.
◇ III. The soft–stop function can efficiently solve the stop–surging problem of inertial system which can not be realized by traditional equipments.
◇ IV. With six unique starting modes so as to be accustomed to complicated conditions of motor and loads and achieve the perfect starting effect.
◇ V. With perfect and reliable protection function so as to protect the safe usage of motor and related production equipments.
◇ VI. The intelligent and networked technology applications of motor soft starter make the motor control technology meet higher requirements of rapid advancing electric power automation technology.

1.2   Main Features of INFLR Series Soft Starter

◆ Reliable quality assurance:
◇ Apply computer simulation design;
◇ SMT mounting production process;

◇ Excellent electromagnetic compatibility;

◇ High temperature ageing and vibration test of overall unit before delivery.

◆ **Perfect and reliable system protection function:**

◇ Novoltage, undervoltage and overvoltage protection;

◇ Soft starter overheating and excessive starting time protection;

◇ Input phase loss, output phase loss, three phases unbalance protection;

◇ Starting over current, running overload, load short circuit protection.

◆ **Maintenance function:**

◇ Fault self−diagnosis (Short circuit, overvoltage, single phase earthing, motor overload, open phase, locked−rotor and intelligent program can analyze and judge the working conditions of dragging system);

◇ Modular combination design, quick trouble shooting according to default display content.

◆ **Product of proprietary intellectual property rights:**

◇ Exclusive motor starting and protection technology;

◇ Unique inspection and debugging equipment and process.

◆ **Prompt and thoughtful after−sale services:**

◇ Good service base on reliable performance and quality;

◇ Provide excellent and perfect matching design scheme;

◇ Timely and Thoughtful usage consultant;

◇ Continuously improve product performance according to user opinions.

2. Product Model Descriptions and Out of Box Audit

Each INFLR series soft starter has been carried out strict inspection and performance test before delivery. After product receiving and package opening, please check by the following steps. Please contact supplier in time if any problem is found.

◆ Out of Box Audit steps:

◇ Check product model: Verify specifications nameplate on product casing to confirm what you receive.

INFR – □ – □ / □

    Applicable voltage: Means AC 380V

    Applicable motor: Such as 505 means the
                   rated motor power is 5.5KW

    Design sequence number: 6000 means digital display
                       7000 means Chinese display

    Product name: INFR7000 Soft Starter
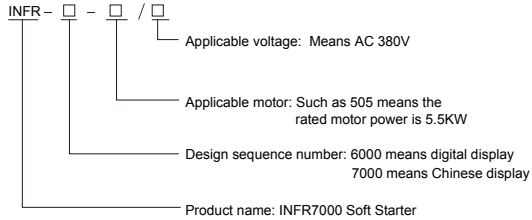
◇ Check whether the product is damaged during transportation, such as abnormal sound caused by internal parts fall apart, casing cracking, deformation, etc.

◇ Check other items: A copy of supporting product inspection certificate and operation manual should be packaged along with the product in packing box of each soft starter.

3. Service Conditions and Installation Requirements

INFLR series soft starter should meet the requirements of following service conditions and installation methods; Or else, the performance will not be guaranteed and severe cases can even result in shortening the service life of soft starter until damage.

3.1 Service Conditions of Soft Starter

◇ Power Supply: Mains supply, captive power station, diesel generator set, three–phase AC 380V or 660V ± 15 ％ , 50Hz or 60Hz. Power capacity shall meet starting requirement of motor for the soft starter.

◇ Applicable Motor: Squirrel–cage three–phase asynchronous motor, motor rated power should be matched with soft starter rated power.

◇ Start Frequency: No requirement, Specific numbers depend on load conditions.

◇ Cooling Method: Natural air cooling.

◇ Protection Grade: IP20

◇ Environmental Condition: 3000 meters below the sea level, environmental temperature between 25℃ ~40℃ , relative humidity below 90 ％ RH, with no condensation, no flammable, explosive and corrosive gas, no conductivity dust, a place with good indoor ventilation and vibration less than 0.5G.

◇ The company can provide products used in special conditions for user, such as explosion proof type, low temperature type and high voltage type soft starter, extra descriptions for service conditions.

3.2 Outline and Installation Dimensions

Soft Starter Model & Specification	Rated Power (KW)	Rated Current (A)	Outline Dimensions			Installation Dimensions			Net Weight (Kg)
			H1	W1	D	H2	W2	Installation Screw Hole	
INFR7000 6(8)-505/3	5.5	11	270	146	160	251	132	M6	>5
INFR7000 6(8)-705/3	7.5	15	270	146	160	251	132	M6	>5
INFR7000 6(8)-11/3	11	23	270	146	160	251	132	M6	>5
INFR7000 6(8)-15/3	15	30	270	146	160	251	132	M6	>5
INFR7000 6(8)-1805/3	18.5	37	270	146	160	251	132	M6	>5

INFR7000 6(8)-22/3	22	43	270	146	160	251	132	M6	>5
INFR7000 6(8)-30/3	30	60	270	146	160	251	132	M6	>5
INFR7000 6(8)-37/3	37	75	270	146	160	251	132	M6	>5
INFR7000 6(8)-45/3	45	90	270	146	160	251	132	M6	>5
INFR7000 6(8)-55/3	55	110	270	146	160	251	132	M6	>5
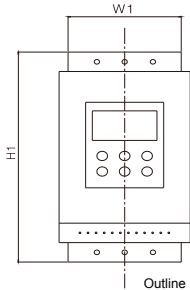
Outline Dimension Drawing of
Applicable Motor 5.5KW~55KW
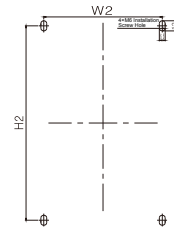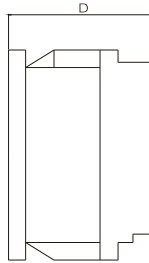
Schematic Drawing of Installation Hole

Soft Starter Model & Specification	Rated Power (KW)	Rated Current (A)	Outline Dimensions			Installation Dimensions			Net Weight (Kg)
			H1	W1	D	H2	W2	Installation Screw Hole	
INFR7000 6(8)-75/3	75	150	535	260	195	380	195	M8	
INFR7000 6(8)-90/3	90	180	535	260	195	380	195	M8	
INFR7000 6(8)-115/3	115	230	535	260	195	380	195	M8	
INFR7000 6(8)-132/3	132	260	535	260	195	380	195	M8	
INFR7000 6(8)-160/3	160	320	535	260	195	380	195	M8	
INFR7000 6(8)-185/3	185	370	535	260	195	380	195	M8	
INFR7000 6(8)-200/3	200	400	535	260	195	380	195	M8	

W1

D

W2

H1

H2

Outline Dimension Drawing of
Applicable Motor 75KW~600KW

Schematic Drawing of Installation Hole
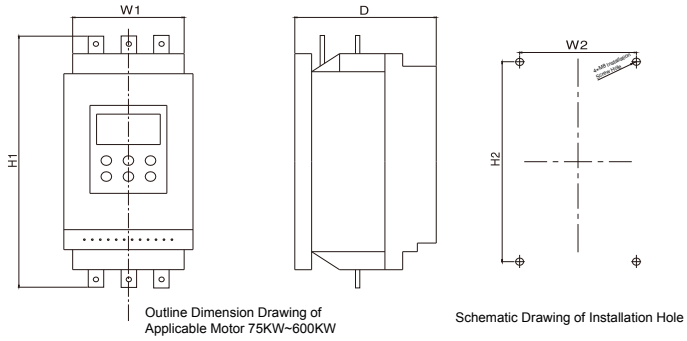
3.3   Real Installation Diagram of INFLR Series Soft Starter

Three-phase
Power Input

Breaker

Computer
Communication
Interface

INFLR Series
Soft Starter

Operation
Control Panel

12 External
Terminals

Bypass Contactor (KM)

Motor

Squirrel-cage Three-phase
Asynchronous Motor
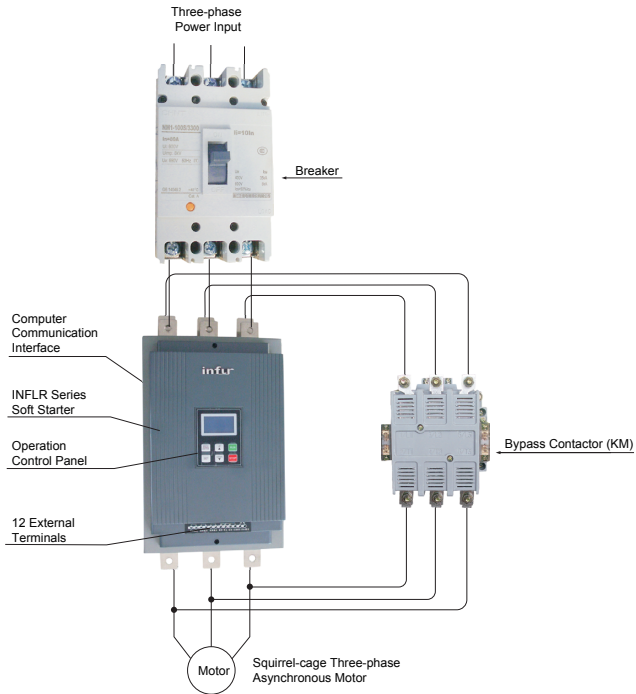
Note: The contact capacity of output contactor is AC 250V 5A

4. External Terminals Descriptions of Soft Starter

External Terminals show as figure 4.2:

1	2	3	4	5	6	7	8	9	10	11	12

Bypass Output — Programming Output — Fault Output — Instantaneous Stop — Stop — Start — Common — DCO~20mA Output

figure 4.2:

| Terminal SN	Terminal Name	Descriptions
1 2	Bypass Output	Apply to control bypass contactor, it's normally open passive contact and close up with successful start.
3 4	Programmable Relay Output	Output mode is set by setting code PJ, it's normally open passive contact and the contact capacity is AC 250V/5A.
5 6	Fault Output	Close up when the soft starter is out of order or loss power, it's open in normal working condition. It's passive contact and the contact capacity is AC 250V/0.5A.
7	Instantaneous Stop Input	This terminal must be connected with terminal 10 when the soft starter is in normal working condition. If this terminal is disconnected with terminal 10, the soft starter will stop unconditionally and stay in fault protection status. This terminal can be controlled by normally closed output-point of external protection device. The function of this terminal will be prohibited when setting code PC is set to be 0(Primary Protection)
8 9 10	External Start and Stop Input	There are two kinds of connection i.e., three-line mode and two-line mode. The connection can be selected as needed.
11 12	DC Analog Output	Apply to carry out real-time monitoring of motor current, the full scale value 20mA means motor current is four times as nominal rated current of the soft starter. It can be observed by external DC ammeter (0~20mA) and the maximum resistance of output load is 300. Be sure not to make wrong connection of external terminals, or else damages of the soft starter can be caused.
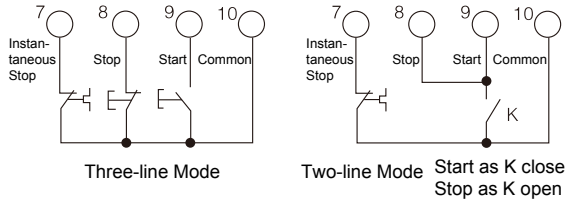
Figure 4.3

◆ Be sure not to make wrong connection of external terminals, or else damages of the soft starter can be caused.

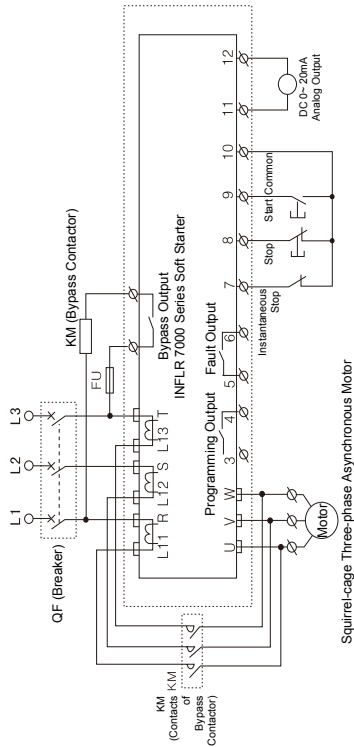## 4.1   Main Circuit Wiring Diagram of INFLR Series Soft Starter

Figure 4.4

INFR7000 用户手册

Note: ○ The standard configuration of soft starter which specification is 55KW or below is three–in and three–out type before delivery i.e., with no running monitoring protection function. It can also be configured to six–in and three–out type as user needed. Among the six input copper bar, upper three are connected to breaker and lower three are connected to bypass contactor.

  ○ The contact of 1and 2 which control bypass contactor is passive relay output point; Break of point 7 is input of instantaneous stop; Break of point 8 is soft stop; Connection of point 9 is soft start; Point 10 is common terminal; Point 3 or 4 is contact of time relay and soft start synchronous delay; Short circuit protection and overload protection are built in the soft starter; Self–resetting of instantaneous stop is programmable; Control modes of current–limiting type and voltage–slope type can be selected freely at will; Point 11 and 12 are 0~20mA analog signal output.

4.2 Communication Interface and Descriptions

◆ INFLR Series Soft Starter is supplied with computer communication interface:

◇ Socket RJ–45 is standard net line socket.

◇ Rs485 and RS232 interfaces are built in socket DB9, the explanation of pins is as follow:

DB9 Socket

Where: 1 is RS485+
          6 is RS485–
          2 is RS232 Output
          3 is Rs232 Input
          4 is +5V Output (Current–limiting 50mA)
          5 is grounding GND
          7 8 9 is empty.
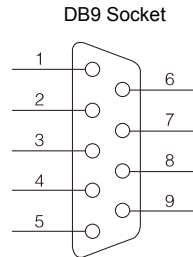
Figure 4.5

◆ The product is equipped with RS232 and RS485 interfaces before delivery, user can choose and buy following components according to different needs:

◇ Computer distributed control communication software;

◇ DeviceNet interface card and communication software;

◇ DeviceNet / Modbus / Profibus gateway;

◇ Other configuration requirements proposed by cluster users.

5. Control Panel and Operations

There are five working conditions of INFLR series soft starter: preparation, running, fault, start and stop. There are related status indicator lamps for preparation, running and fault. "–XXXX" is displayed at starting, "_XXXX" is displayed at stopping and wherein "XXXX" means motor current.

5.1   Keyboard Operating Method

◆ Startup State: Only when preparation indicator lamp is lighted and display "INFLR Technology" or "READY" can the motor be started by pressed start button. "INFLR Technology" will be displayed at the first time of power on, or else display "READY" for ready.

◆ Delay State: Flashing of preparation or fault status indicator lamp means interval delay; Display "dEXXX" and counting down means starting delay.

◇ Start "RUN" and stop "STOP" Key: During soft starting, display "–XXXX" means value of starting current and only stop "STOP" key can be worked at the moment. Configuration and help hint menu can not be accessed and meanwhile indicator lamps of preparation, running and fault are unlighted. During soft stopping, display "_XXXX" means value of motor current and only start "RUN" key can be worked at the moment. Configuration and help hint menu can not be accessed and meanwhile indicator lamps of preparation, running and fault are unlighted. The stop "STOP" key is combined with function of reset fault status.

◇ Setting "SET" Key: Under non–help state, press "SET" key to enter setup menu and display "PX: XXX"; Press setting "SET" key again and the colon will be flashing means parameters behind the colon can be modified. Press confirm "ENTER" key while colon is flashing, display "good" if data has been modified and with two sound, means new data has been saved and then quit. If not

want to save new data, press setting "SET" key. Colon will stop flashing and restore old data, quit by press confirm "ENTER" key and can also quit directly by press stop "STOP" key.

◇ Confirm "ENTER" Key: Under non–setting state, press confirm "ENTER" key to enter help menu and display "HX: XXX". Press confirm "ENTER" key again to quit and press stop "STOP" key to quit as well. Under setting state, press confirm "ENTER" key to save new data and quit setting state.

◇ Up "UP" and down "DOWN" Keys: In setting menu, press up "UP" or down "DOWN" key may change function number when colon is not flashing. When colon is flashing, press up "UP" or down "DOWN" key may change data. Keep pressing up "UP" or down "DOWN" key more than 1 second and data will continuously increase or decrease rapidly. In help menu, press up "UP" or down "DOWN" key to change function number and corresponding message content. When bypass running indicator lamp is lighted and not in setting and help menu, display "AXXXX" and means motor running current. At that moment, press up "UP" or down "DOWN" key may choose to display "PXXXX" or "HXXXX" in turn and wherein "PXXXX" means motor apparent power, "HXXXX" means motor overload heat balance coefficient. When "HXXXX" indicated value is over 100 % , the overload protection will be activated and display "Err08".

◆ When data is over 999, the last decimal point is lighted and means mantissa +0.

◆ There is sound prompt when key operation is valid, or else means this key is invalid in the state.

◆ When external terminals are connected in three–line mode, the functions of external start button and stop button are equal to start "RUN" key and stop "STOP" key on the control panel.

◇ The control panel is applied with super anti–interference design and the allowable extended connection distance is more 3 meters.

5.2   Parameter Setting and Descriptions

Digital Display Parameter Setting Code List as Below:

Table 5.1

Setting Code Descriptions				
Code	Name	Setting Range	Factory Value	Descriptions
P0	Initial Voltage	30-70%	30%	Valid for voltage-slope mode, the initial voltage of current mode is 40%.

P1	Soft Start Time	2-60S	16S	Invalid for current-limiting mode
P2	Soft Stop Time	0-60S	0S	"0" means freely stop, please set value as "0" in one-carry-two wiring mode.
P3	Start Delay	0-999S	0S	Delay in counting down mode, set "0" as no delay for immediate start.
P4	Programmable Delay	0-999S	0S	Use for programmable relay output.
P5	Interval Delay	0-999S	0S	Delay in overheating release as well, status indicator lamp keeps flashing during delay period.
P6	Start Limiting Current	50-500%	280%	Valid for current-limiting mode, the maximum limiting current of voltage-slope mode is 40%.
P7	Maximum Working Current	50-200%	100%	Input mode of parameter P6 and P7 depends on P8.
P8	Input Display Method	0-3	1	See page P15 for detailed descriptions.
P9	Undervoltage Protection	40-90%	80%	Protection for below the set point.
PA	Overvoltage Protection	100-140%	120%	Protection for above the set point.
PB	Start Mode	0-5	1	0--Current-limiting 1--Voltage 2--Sudden Jump + Current-limiting 3--Sudden Jump + Voltage 4--Current-slope 5--Double Closed Loops
PC	Output Protection Permit	0-4	4	0--Primary 1--Light Load 2--Standard 3--Heavy Load 4--Advanced
PD	Operation Control Mode	0-7	1	Set as "7" to prohibit starting or stop operation, see page P15 for detailed descriptions.
PE	Restart Permit	0-13	0	See page P14 for detailed descriptions.
PF	Parameter Modify Permit	0-2	1	See page P15 for detailed descriptions.

PH	Communication Address	0-63	0	Use for multimachine communication between multiple soft starters and upper computer.
PJ	Programming Output	0-19	7	See page P13 for detailed descriptions.
PL	Soft Stop Current-limiting	20-100%	80%	See page P26 for detailed descriptions.
PP	Motor Rated Current		Rated Value	Use for input motor nominal rated current.
PU	Motor Underload Protection		Prohibit	See page P15 for detailed descriptions.
Remarks:	1、The maximum working current of setting item P7 refers to the calculated sustainable running maximum current of motor which is based on PP setting data and this value will be used as inverse time and heat-limiting protection. 2、Under setting state, auto-logout of setting state will be happened if no key operation after 2 minutes. 3、Parameters can be set in all state except in the period of soft starting and soft stopping. 4、Press and hold confirm (ENTER) key to power on and startup, setting parameters (Except PJ) can restore to factory values. Chinese Display Parameter Setting Code List as Below:			

Table 5.2

Setting Code Descriptions				
Code	Name	Setting Range	Factory Value	Descriptions
F0	Initial Voltage	30-70%	30%	Valid for voltage-slope mode, the initial voltage of current mode is 40％.
F1	Soft Start Time	2-60S	16S	Invalid for current-limiting mode.
F2	Soft Stop Time	0-60S	0S	"0" means freely stop, please set value as "0" in one-carry-two wiring mode.
F3	Start Delay	0-999S	0S	Delay in counting down mode, set "0" as no delay for immediate start.
F4	Programmable Delay	0-999S	0S	Use for programmable relay output.
F5	Start Limiting Current	50-500%	280%	Valid for current-limiting mode, the maximum limiting current of voltage-slope mode is 40％.

F6	Maximum Working Current	50-200%	100%	Percentage of motor rated current.
F7	Undervoltage Protection	40-90%	80%	Protection for below the set point.
F8	Overvoltage Protection	100-140%	120%	Protection for above the set point.
F9	Start Mode	0-5	1	0--Current-limiting 1--Voltage 2--Sudden Jump + Current-limiting 3--Sudden Jump + Voltage 4--Current-slope 5--Double Closed Loops
FA	Output Protection Permit	0-4	4	0--Primary 1--Light Load 2--Standard 3--Heavy Load 4--Advanced
FB	Operation Control Mode	0-6	1	0--Keyboard 1--Keyboard + External Control 2--External Control 3--External Control + Communication 4--Keyboard + External Control + Communication 5--Keyboard + Communication 6--Communication 7--Prohibit Operation of Start or Stop
FC	Parameter Modify Permit	0-2	1	See page P12 for detailed descriptions.
FD	Communication Address	0-63	0	Use for multimachine communication between multiple soft starters and upper computer.
FE	Programming Output	0-19	7	Set by Running Relay Output (Terminal 03 and 04)
FF	Soft Stop Current-limiting	20-100%	80%	See page P21 for detailed descriptions.
FP	Motor Rated Current		Rated Value	Use for input motor nominal rated current.

FU	Motor Underload Protection			See page P13 for detailed descriptions.

Remarks: 1、The maximum working current of setting item P6 refers to the calculated sustainable running maximum current of motor which is based on FP setting data and this value will be used as inverse time and heat-limiting protection.

2、Under setting state, auto-logout of setting state will be happened if no key operation within 2 minutes.

3、Parameters can be set in all state except in the period of soft starting and soft stopping.

4、Press and hold confirm (YES) key to power on and startup, setting parameters (Except FE) can be restored to factory values.

5.3 Programmable Relay Output Function

There are two working modes of programmable relay output function i.e., programmable time sequence output mode and programmable status output mode.

◆ When setting item PJ is 0~4(10~14), programmable output works at time sequence output mode. The starting time of setting output is listed as below:

Table 5.2

PJ Setting Value	0(10)	1(11)	2(12)	3(13)	4(14)
Programmable Output Time	Time of Giving Start Command	Time of Starting	Time of Bypass Running	Time of Giving Stop Command	Time of Stop Complete

◇ This working mode contains a timer of 999 seconds and sets by setting item P4. If P4 is not "0", timing begins according to the starting time of setting item P4 and output status will change as timing up. If P4 is "0", output status will change at once. The output reset time is the moment when delay complete according to P4 setting time and maintain one more second under ready status.

◇ Programmable time sequence output mode takes one starting process as control cycle. If restart motor, the last programmable output process will be interrupted automatically and restart the process.

◆ When setting item PJ is 0~4(10~14), programmable output works at status output mode. The setting working status output is listed as below:

Table 5.3

PJ Setting Value	5(15)	6(15)	7(17)	8(17)	9(19)
Output Indicating Status	Fault Status	Running Status	Ready Status	Starting Status	Bypass Status

◇ Programmable status output mode is used for indicating soft starter working status, the time set by setting item P4 is invalid in this mode. The factory value of setting item PJ is "7" i.e., indicating soft starter prepared working status and the motor can be started in this status. When programmable output is in fault status, it means motor-type fault (Err05, Err06, Err07, Err08, Err12, Err15) and is different from function of No. 5 and 6 fault output terminal. Running status means non-ready or fault status and include three processes of start, bypass and soft stop.

◆ When PJ>9, the reset status of programmable output (No. 3 and 4 external terminal) will change open to close i.e., inverse-phase output. Flexible application of programmable relay output function can efficiently simplify peripheral control logical circuit.

5.4   Automatic-restart Function

◆ When setting item PE is 1~9, automatic-restart function will be permitted. The function is valid only in external two-line mode and out of control of external control permit setting item PD. when it's connected as two-line mode and in closed starting status:

◇ Delay 60 seconds and automatically start after power on.

◆ Delay 60 seconds and automatically restart after fault shutdown, but delay as set-time of P5 if set-time of setting item P5 is more than 60 seconds. Indicator lamp will keep flashing in delay period.

◇ It can automatically start for "n" times include power-on start and restart after fault, "n" is the set value of setting item PE.

◇ The auto-start mode can not be valid unless power on once again and will be valid after each time of power-on.

◆ When setting item PE is 10, power fail protection function is prohibited. When power on, the motor will start automatically i.e., power on start is permitted if external control start terminal is already in closed status.

◆ When setting item PE is 11, it can restart after instantaneous stop: When external control No. 7 instantaneous stop terminal is not prohibited (Setting item PC>0), the motor can start without reset as fault occurred and recovered such as instantaneous stop, overheat, overvoltage, undervoltage, etc.

◆ When setting item PE is 12, power fail protection function is prohibited and it can restart after instantaneous stop.

◆ When setting item PE is 13, running status memory recovery function: That is, power off under bypass running status and power on again, soft starter fully auto-start and restore to bypass running status.

◆ Warning: The soft starter is with novoltage protection function i.e., after power off and power on again, no matter what kind of position the external control terminal is in, it will not start by itself so as to avoid injury accidents. But power fail protection function will be invalid when auto−start function is permitted, novoltage protection is prohibited and running status memory recovery function is permitted!

5.5 Descriptions of Other Settings

◆ Setting item P8 is used for input selection and display mode and be listed as below:

Table 5.4

P8 Set Value	0	1	2	3
P6, P7 Input Mode	Current Value	Percentage	Current Value	Percentage
Running Display Mode	Current Value	Current Value	Percentage	Percentage

◇ When setting item P6 and P7 are in percentage input mode, it means motor current value percentage set by setting item PP.

◆ Setting item PD is used for selection of motor start control mode and be listed as below:

Table 5.5

Value	0	1	2	3	4	5	6	7
Keyboard	1	1	0	0	1	1	0	0
External Control	0	1	1	1	1	0	0	0
Communication	0	0	0	1	1	1	1	0

◇ In the table, "1" means permit and "0" means prohibit. For example, if accidental stop is not permitted after start or accidental start is not permitted during maintenance, set this item as "7" and all start or stop operation will be prohibited.

◇ when external control is permitted, one normally closed push button switch or short circuit shall be connected between external control terminal 8 and 10, or else the motor can not be started.

◆ Setting item PF is permit selection item of parameter modification, there are three selections:

◇ When setting item PF is "0", modification of any parameter is prohibited except setting item PF.

◇ When setting item PF is "1", value modifications of setting item P4, P7, P8, PE, PH, PJ, PL and PU are prohibited.

◇ When setting item PF is "2", data modifications of all setting items are permitted.

◆ Setting item PU is used for setting up motor underload protection function.

◇ When setting item PU<10, motor underload protection function is prohibited.

◇ The range of underload protection current is 10%~90% of motor rated current and is determined by the tens digit of setting item PU.

◇ The range of underload protection delay is 5~90 seconds and is determined by the single digit of setting item PU multiplying by ten. When the single digit of setting item PU is "0", protection action delay is 5 seconds. When setting item PU=42, it means underload current is 40% and protection action delay is 20 seconds.

5.6 Help Information and Descriptions

◆ Help information prompt is listed as below:

Table 5.6

Display	Descriptions
AC:XXX	3-digit digital voltmeter, it's used for monitoring three-phase AC power voltage.
055-3	Prompt that the specification of this soft starter is 55KW-380/50Hz.
H1:E05	Prompt that the last occurred fault information is Err05.
H2:E01	Prompt that the occurred fault information is Err01.
H3:E06	Prompt that the occurred fault information is Err06.
⋮	⋮
H9:E00	Prompt that no fault information.
UErl.7	Prompt that software version of the product is Ver. 1.7
LXXXX	Total number of successful start.
RUNXX	Time taken for last soft start (No matter succeeded or not)
Note: H1~H9 are used with recurrence method to store the newly occurred nine fault information.	

◇ Under non–soft start and soft stop status and without entering setting status, help menu can be accessed by pressing confirm key. Prompt information is optional by pressing the up or down key then.

◇ Under help status, press confirm key or stop key to quit h

6. Protection Functions and Descriptions

◆ INFLR series soft starter is provided with perfect protection function so as to protect usage safety of soft starter and motor. The protection level and protection parameters should be set properly according to different conditions in using process.

6.1　Protection Functions and Related Parameters

◇ Soft starter overheat protection: Protection is activated when temperature reach 80 ℃ ±5 ℃ . Overheat protection will be released when temperature drop to 55℃ (Minimum).

◇ Delay time of input phase failure protection: < 3 seconds.

◇ Delay time of output phase failure protection: < 3 seconds.

◇ Delay time of three－phase imbalance protection: < 3 seconds. Based on the deviation of each phase current is more than 50% ± 10%, judge the datum drift will increase when load current is less than 30% of soft starter nominal rated value.

◇ Protection time of starting overcurrent: See table 6.1 for protection time of current which is continuously over 5 times maximum working current of setting item P7.

◇ Protection time of running overload: Inverse time thermal protection is based on maximum working current of setting item P7, tripping protection time curve is shown as figure 6.1.

◇ Delay time of power undervoltage protection: When power voltage is lower than 40% of limit value, protection action time is less than 0.5 second. Or else when it's lower than set value, protection action time will be less than 3 seconds.

◇ Delay time of power overvoltage protection: When power voltage is higher than 140% of limit value, protection action time is less than 0.5 second. Or else when it's higher than set value, protection action time will be less than 3 seconds.

◇ Delay time of load short circuit protection: < 0.1 second, the current is more than 10 times soft starter nominal rated current. This protection can not replace the fuse protection device.

◇ Motor underload protection: The current range is 10%~90% of motor rated current, protection action delay time is 5~90 seconds.

◆ Parameters above are started from detection of valid signal till issue of tripping protection command, parameters are for reference only. All protection functions listed with INFLR series soft starter can be verified by actual or analog method, microcomputer motor protection device of Shanghai Huajian should be added to ensure safety if the parameters can not meet user's requirements.

6.2   Protection Level Setting Descriptions

◆ In order to adapt to various applications, INFLR series soft starter is equipped with five protection levels and respectively are: 0: Primary, 1: Light Load, 2: Standard, 3: Heavy Load, 4: Advanced. They are set by setting item PC and wherein:

◇ Primary protection prohibit external instantaneous stop terminal function and meanwhile only reserve fault protections of overheat, short circuit and main circuit. It's suitable for occasion of unconditional emergency start, such as fire protection system and so on.

◇ Protection levels of light load, standard and heavy load are equipped with complete protection function, the difference between them is the different motor overload thermal protection time curve. See table 6.1 and figure 6.1 for the motor thermal protection time.

◇ The protection standard of starting for advanced protection is stricter and other protection parameters are the same as standard protection settings.

◆ The different protection level and thermal protection time set by setting item PC listed as below:

Table 6.1

PC Settings	0 (Primary)	1 (Light Load)	2 (Standard)	3 (Heavy Load)	4 (Advanced)	Descriptions
Running Overload protection Level	No	Level 2	Level 10	Level 20	Level 10	According to Standard IEC60947-4-2
Starting Overcurrent Protection Time	No	3s	15s	30s	15s	Count according to starting current is over 5 times set value of P7.
Running Overload Tripping Time Table — Current Multiple (I/Ie)		3 | 4 | 5	3 | 4 | 5	3 | 4 | 5	3 | 4 | 5	Value in the table is typical value
Running Overload Tripping Time Table — Tripping Time (s)		4.5 | 2.3 | 1.5	2.3 | 12 | 7.5	46 | 23 | 15	23 | 12 | 7.5	

◇ The rated current values should be entered into setting item PP according to motor nameplate, or else starting current and protection current will have great deviation when input mode of setting item P6 and P7 is percentage mode (Set by setting item P8).

◇ Motor current set by setting item PP can not be lower than 20% of soft starter nominal current. The sensitivity tolerance of protection tripping action will be increased when the motor current set by PP is minor.

The Motor Thermal Protection Tripping Time Curve According to Standard IEC60947−4−2 is shown as below:
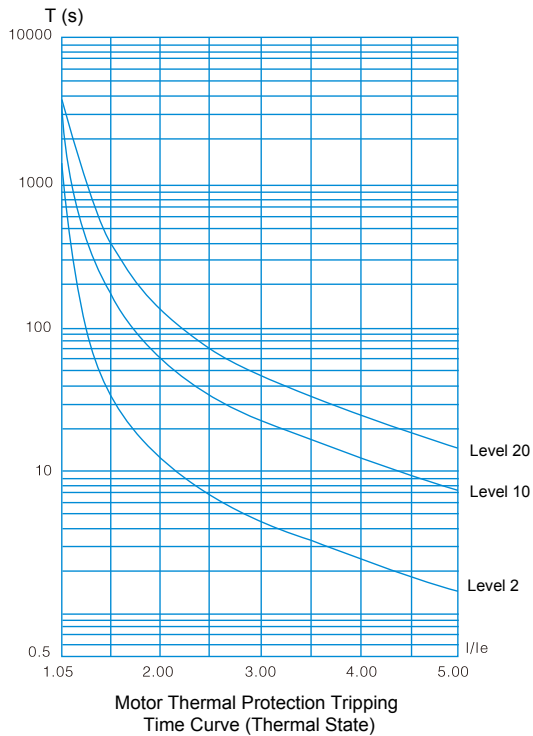

Motor Thermal Protection Tripping
Time Curve (Thermal State)

Figure 6.1

7. Commissioning and Applications

◆ Check carefully with the following items before power on to run:

◇ Whether soft starter rated power is matched with the motor.

◇ Whether motor insulating property meet the requirement.

◇ Whether input and output main circuit wirings are correct.

◇ Whether all terminal screws are tighten.

7.1   Electrical Commissioning

◇ "INFLR Technology READY (Prepared)" is displayed when power on and ready state indicator lamp is lighted. The motor can be started by pressing start key at this moment.

◇ Enter rated current values into setting item PP according to motor nameplate.

◇ Check rotation direction of the motor is correct or not after starting and whether running is normal. If not, press stop key to stop the machine or switch off the power as necessary.

◇ If the motor starting status is not ideal, select the suitable starting mode by referring to starting modes of soft starter and applications of chapter 7.2 in page P22.

◇ If the motor starting torque is not enough, change the initial voltage (Voltage mode) or current−limiting value to improve motor starting torque.

◇ Please do not open the roof cover after soft starter is powered on so as to avoid electric shock.

◇ During power on running process, shut off the power supply at once and find out the reason if anything abnormal is found, such as abnormal sound, smoking or unusual smell, etc.

◇ After power on or starting, if the fault indicator lamp is lighted and display "ErrXX", find out the reason by matching the displayed fault code with table 7.1 in page P21.

◆ Press stop key or external control stop button to reset fault status.

◆ Note: When ambient temperature is lower than −10℃ , it should be powered on and preheating for more than 30 minutes

Fault Code and Treating Methods are listed as below:

Display	Descriptions	Problem and Treating Methods
ERR00	Fault lifted	Faults such as undervoltage, overvoltage and open circuit of instantaneous stop terminal and so on have just happened and be normal now. Ready lamp is lighted at this moment and motor can be started after reset.
ERR01	Open circuit of external instantaneous stop terminal	Connect external instantaneous stop terminal 7 to common terminal 10 or connect to normally closed contact of other protection device.
ERR02	Soft starter overheating	Start too frequently or motor power is not matched with soft starter.
ERR03	Start time is too long and over 60s	Start parameter settings are not suitable or load is too heavy, power capacity is not enough, etc.
ERR04	Input phase failure	Check input or main circuit fault, whether bypass contactor is stuck in closed position and whether thyristor is opened, etc.
ERR05	Output phase failure	Check output or main circuit fault, whether bypass contactor is stuck in closed position and whether thyristor is short, etc.
ERR06	Three-phase unbalance	Check whether input three-phase power supply and load motor are abnormal.
ERR07	Starting overcurrent	Whether load is too heavy or motor power is not matched with soft starter.
ERR08	Running overload protection	Whether load is too heavy or setting item P7 and PP parameter settings are not suitable.
ERR09	Power voltage too low	Check input power voltage or setting item P9 parameter settings are not suitable.
ERR10	Power voltage too high	Check input power voltage or setting item overvoltage protection parameter settings are not suitable.
ERR11	Setting parameter wrong	Modify settings or hold pressing confirm key and power on to restore to factory value.
ERR12	Load short circuit	Check load or whether thyristor is short or load is too heavy.
ERR13	Auto-restart wrong wiring	Check whether external start and stop terminals are not connected in two-line mode.
ERR14	External stop terminal wrong wiring	External stop terminal is in opened status when external control mode is permited, so that the motor can not be started.
ERR15	Motor underload	Check motor main shaft and load fault.
Remarks:	Some fault phenomena are interrelated, for example, reporting Err02 of soft starter overheating maybe related to starting overcurrent or load short circuit and so on. Therefore, comprehensive consideration should be taken in checking fault so as to determine the fault point accurately.	

Note: When the motor is successfully started by soft starter, running status indicator lamp in middle of the panel is lighted and means it's in bypass running status. If the motor stops running because of unclosed bypass contactor, check whether bypass contactor and related wirings are wrong or poor contact.

7.2 Starting Mode and Applications of INFLR Series Soft Starter

There are six starting modes of INFLR series soft starter to suit various complicated motors and load conditions, user can make the selection according to different applications.

7.2.1 Current–limiting Starting Mode:

When setting item PB is "0", the setting starting mode is this mode.

Figure 7.1 shows the motor current varying waveform of current–limiting starting mode, wherein II is the setting starting current–limiting value. When motor is starting, the output voltage increase rapidly until motor current reach the setting current–limiting value II and maintain motor current no more than that value. Then along with gradually increasing output voltage, motor speeds up gradually. When the motor reach rated rotating speed, bypass contactor will be closed. The output current drop rapidly to motor rated current Ie or below and then start process is completed.

When motor load is light or setting current–limiting value is high, it's normal that maximum current of starting may not reach the setting current–limiting value.

Current–limiting starting mode is usually used in occasion with strictly limited requirements to starting current.
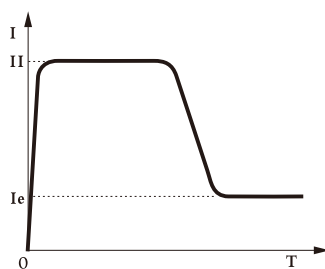

Figure 7.1

7.2.2 Voltage–slope Starting Mode:

When setting item PB is "1", the setting starting mode is this mode.

Figure 7.2 shows the output voltage waveform of voltage–slope starting mode, wherein U1 is the setting starting current–limiting value. When motor is starting, in the range of motor current is no more than 400% of rated value, soft starter output voltage rapidly increase to U1. Then output voltage increase gradually according to the setting starting parameter and motor continuously accelerate smoothly along with the increasing voltage. When voltage reaches rated voltage Ue, bypass contactor will be closed and then start process is completed.

Starting time "t" is the control parameter attained by standard load under standard experimental conditions, INFLR series soft starter is based on this parameter. Let the motor accelerate smoothly by controlling output voltage so as to complete starting process, but not mechanically control the time "t" and despite whether motor acceleration is smooth or not. Because of this, the starting time is often less than setting starting time when load is light and it's normal as long as the start is smooth.

In general, voltage–slope starting mode is suitable for the occasion with not so strict requirements to starting current but higher requirements to starting stationarity.
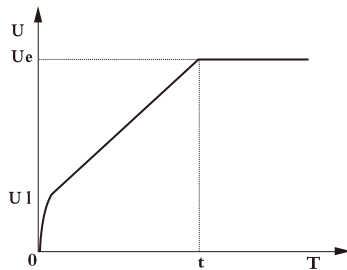

Figure 7.2

7.2.3 Sudden–jump Starting Mode:

When setting item PB is "2" or "3", the setting starting mode is this mode.

Figure 7.3 and figure 7.4 show the output current varying waveform of sudden–jump starting mode. In some heavy load occasions, this starting mode is optional when motor can not start because of the effect of mechanical static friction. During starting, apply a higher fixed voltage to the motor firstly and last a limited period so as to overcome the static friction of motor load to let the motor rotating. Then start according to current–limiting (Figure 7.3) or voltage–slope (Figure 7.1).

Before using this mode, start the motor by sudden–jump mode first and then select this mode if motor can not rotate because of too much static friction. Or else try not to use this mode to start so as to reduce the unnecessary large current impact.
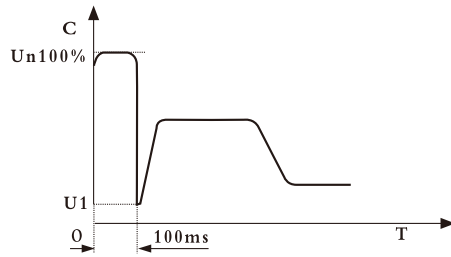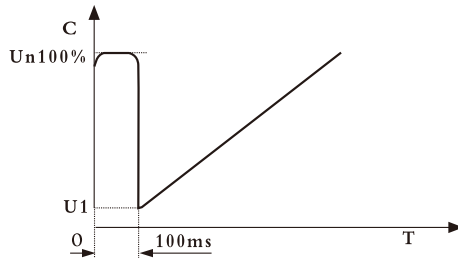
Figure 7.3

Figure 7.4

7.2.4 Current−slope Starting Mode:

When setting item PB is "4", the setting starting mode is this mode.

Figure 7.5 shows the output current waveform of current−slope starting mode, wherein II is the current−limiting value set by P6 and T1 is time value set by P1.

Current−slope starting mode is provided with strong acceleration ability and be suitable for bipolar machine. It can shorten starting time in a certain range.
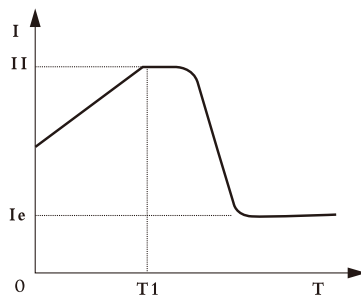

Figure 7.5

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7.2.5 Voltage Current–limiting Double Closed Loops Starting Mode:

When setting item PB is "5", the setting starting mode is this mode.

Voltage current–limiting double closed loops starting mode adopts voltage–slope and current–limiting double closed loops circuit control, it's an integrated starting mode which requires not only smooth starting but also strict current–limiting. It adopts predictive method of estimating the motor working status.

The output voltage waveform of this starting mode will vary according to motor and load conditions.

7.3   Stop Mode and Applications of INFLR Series Soft Starter

There are two stop modes of INFLR series soft starter i.e., soft stop mode and free stop mode.

7.3.1 Soft Stop Mode:

When setting item P2 is not "0", the setting starting mode is this mode.

Under this stop mode, motor power supply is switched from bypass contactor to thyristor output of soft starter. The output voltage of soft starter reduces gradually from full–voltage and let motor rotating speed dropping smoothly so as to avoid mechanical vibration until motor stop running. The output cutoff voltage of soft stop is equal to the initial voltage of starting.

Soft stop mode can reduce and eliminate load surge of water pump type.

◇ Soft stop mode can set the soft stop limiting current value by setting item PL so as to reduce large current impact when soft stopping. Note that this soft stop limiting current value is calculated percentage based on starting limiting current value.

7.3.2 Free Stop Mode:

When setting item P2 is "0", the setting starting mode is this mode.

Under this stop mode, soft starter will disconnect bypass contactor and prohibit voltage output of soft starter thyristor after received stop command. The motor will stop gradually by load inertia. In one–carry–two (More) wiring mode, stop mode of soft starter should be set as this mode so as to avoid phase failure fault report of output switch.

In general, free stop mode should be selected if soft stop is unnecessary so as to prolong the service life of soft starter.

◇ Free stop mode completely prohibits instantaneous output so that instantaneous large current impact in special occasions can be avoided.

7.4   Special Applications

◆ Starting of Parallel Motors:

◇ Motors can be connected in parallel (The sum of motors current can not exceed the rated current of soft starter selected according to application type) if it's under the limitation of soft starter rated power. But extra thermal protection device for each motor should be provided in this case.

◆ Starting of Double Speed Motor:

◇ INFLR series soft starter can cooperate with the starting of double speed motor. It must pass through the delay degaussing period before change into high–speed from low–speed so as to avoid occurrence of great inverse phase current between lines and motor.

◆ Very Long Cable:

◇ Because of cable resistance, very long cable can cause voltage dropping. If voltage dropping is very obvious, it will affect current loss and starting torque. So this must be taken into consideration for the selection of motor and soft starter.

◆ Soft Starters Paralleled in the Same Power Line:

◇ If several soft starters are installed in the same power line, inlet reactor should be installed in the middle of lines between transformer and soft starters. The reactor should be installed between each inlet breaker and soft starter.

◆ Application of Surge Protection Device (SPD):

◇ Surge protection device should be considered to install in occasions where overvoltage, overcurrent and surge interference maybe caused in the application system by lightning or other reasons. Detailed application methods please refer to product sample or other related materials of "Surge Protection Device (SPD)" from Shanghai Shenyu Company.

7.5   Application Examples

◆ Setting parameters under various load conditions are listed as table 7.2. Data in the table is for reference only and corresponding adjustment should be taken according to actual conditions.

Table 7.2

Load Type	Starting Time (s)	Initial Voltage	Voltage Starting (Maximum Current–limiting Value)	Current–limiting Starting
Ball Mill	30	60%	4	4.5
Air Blower	26	30%	4	3.5
Centrifugal Pump	16	40%	4	2.5
Piston Compressor	16	40%	4	3
Lifting Machine	16	60%	4	3.5
Blender	16	50%	4	3
Crusher	16	50%	4	3.5
Screw Compressor	16	40%	4	3
Conveyer	20	40%	4	2
Light Load Motor	16	30%	4	3
Inverse Belt Conveyer	20	40%	4	2.5
Heat Pump	16	40%	4	3

Appendix I

Reference list of Peripheral Accessories Specifications and Parameters for INFR7000 Series Soft Starter (5.5KW~75KW):

Soft Starter Model	Rated Power (Unit: KW)	Rated Current (Unit: A)	Matched Breaker Model (OF)	Matched Cutoff Contactor Model (KM)	Primary Line Specification	Remarks
INFLR6(8)-505/6	5.5	11	CM1-63L/16	CJ20-16	2.5mm² Cable	Wiring of 55kW and below is three-in and three-out, usually thermal relay or motor protector is needed to install in the bypass contactor circuit as running protection. May also open the upper cover, change to six-in and three-out by adding three cables at A-pole of three modules or offer the setting requirement of six-in and three-out when ordering. Or else online protection function is not provided.

Rated power and rated current means the maximum rated value of soft starter. |
INFLR6(8)-705/3	7.5	15	CM1-63L/20	CJ20-16	4mm² Cable	
INFLR6(8)-11/3	11	23	CM1-63L/32	CJ20-25	6mm² Cable	
INFLR6(8)-15/3	15	30	CM1-63L/40	CJ20-40	10mm² Cable	
INFLR6(8)-1805/3	18.5	37	CM1-63L/50	CJ20-40	10mm² Cable	
INFLR6(8)-22/3	22	43	CM1-63L/63	CJ20-63	16mm² Cable	
INFLR6(8)-30/3	30	60	CM1-100L/80	CJ20-63	25mm² Cable	
INFLR6(8)-37/3	37	75	CM1-100L/100	CJ20-100	25mm² Cable	
INFLR6(8)-45/3	45	90	CM1-160L/125	CJ20-100	25mm² Cable	
INFLR6(8)-55/3	55	110	CM1-160L/165	CJ20-160	35mm² Cable	
INFLR6(8)-75/3	75	150	CM1-225L/180	CJ20-160	35mm² Cable	

Appendix I. Reference list of Peripheral Accessories Specifications and Parameters for INFR7000 Series Soft Starter (75KW~320KW):

Extended List

Soft Starter Model	Rated Power (Unit: KW)	Rated Current (Unit: A)	Matched Breaker Model (OF)	Matched Cutoff Contactor Model (KM)	Primary Line Specification	Remarks
INFLR6(8)-75/3	75	150	CM1-225L/180	CJ20-160	30x3mm² Copper Bar	Wiring of 75kW and above is six-in and three-out, online protection function is still provided after bypass contactor is closed and no need to add motor protection device.\n\nRated power and rated current means the maximum rated value of soft starter. The specification of matched breaker and bypass contactor should be matched with specification of electric appliances.
INFLR6(8)-90/3	90	180	CM1-225L/225	CJ20-250	30x3mm² Copper Bar	
INFLR6(8)-115/3	115	230	CM1-225L/315	CJ20-250	30x3mm² Copper Bar	
INFLR6(8)-132/3	132	260	CM1-400L/315	CJ20-400	30x4mm² Copper Bar	
INFLR6(8)-160/3	160	320	CM1-400L/350	CJ20-400	30x4mm² Copper Bar	
INFLR6(8)-185/3	185	370	CM1-400L/400	CJ20-400	40x4mm² Copper Bar	
INFLR6(8)-200/3	200	400	CM1-400L/500	CJ20-400	40x4mm² Copper Bar	
INFLR6(8)-250/3	250	500	CM1-630L/600	0CJ20-630	40x5mm² Copper Bar	
INFLR6(8)-280/3	280	560	CM1-630L/630	CJ20-630	40x5mm² Copper Bar	
INFLR6(8)-320/3	320	640	CM1-630L/700	CJ20-630	40x5mm² Copper Bar	