Bölüm 1 **Uyarilar** 4

Bölüm 2 **Genel Tanimlar**

2.1 Kisaca 5
2.2 Özellikler Listesi 5
2.3 Parça Numarasi Formati 5

Bölüm 3 **Spesifikasyonlar**

3.1 Mevcut Güçler 6
3.2 Boyut ve Agirliklar 8
3.3 Yari iletken Sigortalar 9
3.4 Güç Baglantilari 10
3.5 Genel Teknik Datalar 11

Bölüm 4 **Kurulum**

4.1 Genel Baglanti Diagramlari 12
4.2 Güç Baglanti Konfigürasyonlari 12
4.3 Montaj Talimatlari 13
4.4 Vantilasyon 14

Bölüm 5 **Güç Devreleri**

5.1 Genel Bakis 15
5.2 3Kablolu Baglanti 15
5.3 3 Kablolu Baglanti (Bypass Operasyon ile) 15
5.4 6 Kablolu Baglanti 15
5.5 6 Kablolu Baglanti (Bypass Operasyon ile) 16
5.6 DC Frenleme 16
5.7 Güç Faktoru Düzeltme 17
5.8 Hat Kontaktörleri 17

Bölüm 6 **Kontrol Devreleri**

6.1 Elektik Semalari 18
6.2 Kontrol Beslemesi 18
6.3 Kontrol Baglantisi 19
6.4 RS485 Seri Komünikasyon 20
6.5 IMS2 ASCII Protokol 21
6.6 MODBUS Protocokol 25

Bölüm 7 **Programlama & Isletim**

7.1 Programlama Prosedürü 27
7.2 Fonksiyon Listesi 28
7.3 Fonksiyon Açiklamalari 29
7.4 Isletim 49

Bölüm 8 **Uygulama Örnekleri**

8.1 Hat Kontaktörleri ile Kurulum 51
8.2 Bypass Kontaktörleri ile Kurulum 51
8.3 Acil Durum Isletimi 52
8.4 Yardimci Açtirma Devresi 52
8.5 Soft frenleme 53
8.6 Çift Hizli Motor Ayarlari 54

Bölüm 9 Problem Giderme

9.1 Hata Kodlari 55
9.2 Hata kayitlari 57
9.3 Genel Arizalar 58
9.4 Test & Ölçümler 59

Bölüm 10 Ekler

10.1 Soft Starter Teknolojisi 60
10.2 Indirgenmis Gerilim ile Startlama 61
10.3 Yildiz Üçgen Startlama 61
10.4 Oto-Trafo ile Startlama 62
10.5 Primer Direnç ile Startlama 62
10.6 Soft Starterler 62
10.7 Tipik Start Akim Gereksinimleri 63

Temel Setup Prosedürleri

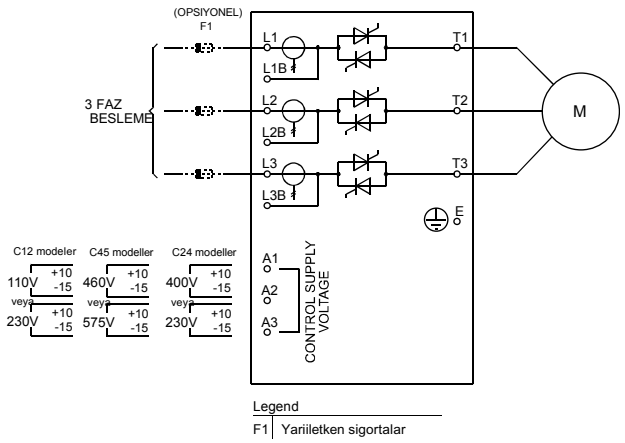
Basit uygulamalar için IMS2 soft starterleri asagidaki üç adimin uygulanmasi ile devreye alinabilir. Daha karmasik kontrol,koruma yada etkilesim gerektiren uygulamalar icin, bu kullanim kilavuzunun detayli olarak incelenip irdelenmesi gerekmektedir.

1. Kurulum & Baglantilar

UYARI - ELEKTRIK SOK TEHLIKESI

IMS2 sebekeye baglandiginda tehlikeli düzeyde gerilim mevcuttur. Yalnizca uzman bir elektrikçi tarafindan montaj ve baglanti yapilmalidir. Uygun yapilmayan motor ya da IMS2 baglantisi cihaz arizalarina, kazalara, ciddi yaralanmalara hatta ölüme neden olabilir. Bu kilavuz talimatlarina, ulusal ve uluslararasi (NEC/IEC76) elektrik standartlarina mutlaka uyunuz.

1. Baglanacak motor ve uygulamaya göre uygun IMS2 modelinin secildigine emin olunuz.
2. IMS2 starteri,alt ve üstünden serbest hava dolasimi olabilecek sekilde bosluk birakmaya dikkat ederek montaj yapiniz. (Daha detayli bilgi icin Bölüm 4.3; *montajda dikkat edilecek hususlar.*)
3. Sebeke kablolarini starter input terminallerine (L1, L2 & L3) baglayiniz.
4. Motor kablolarini starter output terminallerine (T1, T2 & T3) baglayiniz.
5. Starter kontrol devresi input terminallerine baglanti yapiniz : A1 & A2 ya da A2 & A3. (daha detayli bilgi *icin : Bölüm 6.2 Kontrol Besleme Devresi*).



2. Programlama

Temel programlama sadece baglanacak motorun etiket akim degerinin (FLC) girilmesi ile yapilabilir. Bunun icin lütfen asagidaki adimlari uygulayin :

1. Function tusunu basili tutarak ayni anda üst ok tusuna basin, displayde "1" görününce birakin.
2. **<FUNCTION>** tusunu biraktiginizda displayde hafizadaki mevcut *Motor Etiket Akim degeri (FLC) görünecektir*.
3. **<UP>** ve **<DOWN>** tuslarini kullanarak baglanacak motora ait gerekli FLC akim degerini ayarlayin.
4. **<STORE>** tusuna basarak yeni FLC degerini hafizaya alin.
5. Programlama modundan çikmak için **<FUNCTION>** tusuna ve sonra alt ok **<DOWN>** tusuna display "0" gösterene kadar basin ve sonra tuslari birakin.

3. Isletme IMS2 su anda motorunuzu kontrol etmeye hazirdir. Motor calismasi IMS2 lokal kontrol panelindeki **<START>** ve **<STOP>** tuslari kullanilarak kontrol edilebilir. Çok kullanilan diger iki fonksiyon, Fonksiyon 2 Akim Limiti ve Fonksiyon 5 *Stop Rampa Zamanidir*. Bu fonksiyonlar yukarida belirtildigi gibi ayni sekilde ayarlanabilir (Daha fazla ve detayli programlama prosedürleri için Bölüm 7.1 Programlama prosedürleri kismina bakiniz.

UYARILAR

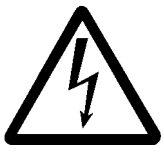
Bölüm 1 Uyari Ifadeleri

Bu sembol, tüm kullanici el kitabi içinde IMS2 soft starter kurulumu ve isletimi esnasinda karsilasilabilecek ve dikkat edilmesi gereken özel ifadelere dikkat çekmektedir.

Ikaz ifadeleri olasi her potansiyel cihaz hasar ve ariza durumunu tanimlamamakla birlikte sik karsilasilan pek coguna dikkat cekmektedir. Bu yüzden kullanici el kitabindaki tüm uyari ve talimatlari dikkate almak, gerekli elektrik uzmanlik bilgi ve yönetmeliklerini uygulamak ve cihazi çalistirmadan once gerekirse profesyonel destek istemek tümüyle kullanicinin kendi sorumlulugudur.

- IMS2 ve motor üzerinde çalismadan önce sistemlerin sebekeden tamamen izole ve enerjisiz olduguna emin olunuz.
- Cihaz kabini içine yabanci madde (özellikle metal) girmesi arizalara yol açabilir.
- Control input terminallerine gerilim uygulamayiniz. Bunlar aktif 12/24VDC inputlaridir ve potansiyel serbest devrelerle kontrol edilmelidir.
- Kontrol inputlarini çalistiran kontak ve anahtarlarin düsük gerilim ve düsük akim için uygun olduguna emin olunuz (altin uçlu kontak yada benzeri).
- Kontrol input kablolarinin AC güç ve kontrol kablolarindan ayri çekildiginden emin olunuz.
- Bazi güç kontaktör bobinleri elektronik kart röleleriyle direk anahtarlama için uygun degildir. Emin olmak için kontaktör üreticisi/saticiniz ile temasa geçiniz.
- Güç faktörü kompanzasyon kapasitörlerini IMS2 nin çikis (output) uçlarina baglamayiniz Eger statik güç kompanzasyonu uygulanacaksa, bu baglanti IMS2'nin sebeke tarafindaki giris (input) uçlarina yapilmalidir.
- IMS2 hat kontaktörsüz baglanti yapilacaksa bunun yerel standart ve kanunlara uygun .olduguna emin olunuz.
- Eger IMS2 vantilasyonsuz bir pano yada ortamda çalisacaksa bypass kontaktörü, olusan asiri isinma riskine karsi mutlaka kullanilmalidir.
- Bypass kontaktörü kullanilirken faz ve motor baglantilarinin dogru olmasina dikkat ediniz (L1B-T1, L2B-T2, L3B-T3)
- DC frenleme kontaktörü kullaniliyorsa faz baglantilarinin dogru olmasina dikkat ediniz (T2-T3 gibi).
- Kontrol voltajinin kesilmesi termal modellemeyi resetler.

Bu manueldeki örnek ve diagramlar yalnizca illustrasyon amaçlidir. Kullanicilar bunlarin ve manuldeki diger bilgilerin önceden haber verilmeden degistirilebilecegine dikkat etmelidirler. Bu cihazlarin kullanimindan . ortaya çikabilecek direk, indirek yada sonuçsal hicbir zararin sorumlulugu üretici ve ithalatçi firmaya ait olmayip tamamen kullanicinin kendi sorumluluk ve insiyatifindedir.



UYARI - ELEKTRIKI SOK TEHLIKESI IMS2 sebekeye baglandiginda tehlikeli düzeyde. gerilim mevcuttur.Yalnizca uzman bir elektrikçi tarafindan montaj ve baglanti yapilmalidir. Uygun yapilmayan baglanti, cihaz arizalari, ciddi kaza,yaralanma ve hatta ölüme sebebiyet verebilir.
Bu kullanici el kitabi talimatlarina,ulusal ve uluslararasi (NEC/IEC76) elektrik standartlarina mutlaka uyunuz !

TOPRAKLAMA VE BRANS DEVRE KORUMASI
Ulusal ve uluslararasi (NEC/IEC76) standartlara uygun topraklama ve brans devre korunmasinin temini IMS2 kullanici kisi yada kurulusun kendi sorumlulugundadir.

Bölüm 2 Genel Tanimlar

2.1 Kisaca

IMS2 Serisi, mikrokontrolör esasli ve en son soft starter teknolojilerine göre tasarlanmis bir cihazdir. En gelismis yumusak kalkis, yumusak durus ve motor koruma özelliklerine sahip üstün bir elektronik motor starteridir.

2.2 Özellik Listesi

Start
- Sabit akim modu
- Akim rampa modu
- Torq kontrolü
- Kickstart

Stop
- Soft stop
- Pompa durusu
- Soft frenleme
- DC frenleme (F2 modellerde)

Koruma
- Motor termal modelleme
- Motor termistör girisi
- Faz dengesizligi
- Faz sira düzensizligi
- Elektronik shearpin
- Düsük akim koruma
- Yardimci açtirma girisi
- Starter asiri isinma
- Asiri yolalma zamani
- Besleme frekansi
- Tristör kisa devre
- Güç devresi
- Motor baglanti hatasi
- Seri interface hatasi

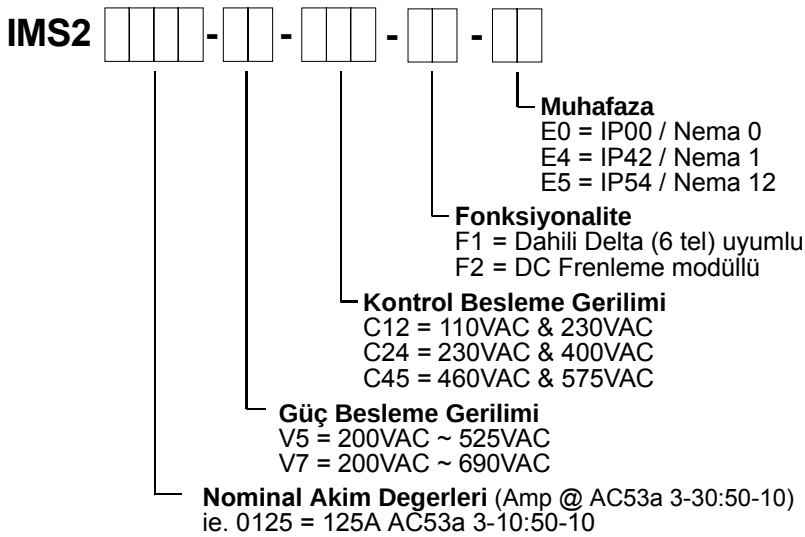
Etkilesim Formatlari
- Remote kontrol input'lari (3 sabit, 1 programlanabilir)
- Röle çikislari (1 sabit, 3 programlanabilir)
- 4-20mA çikis (1 programlanabilir)
- RS485 seri link

Insan Etkilesimi
- Lokal butonlar (Start, Stop, Reset, Lokal/Remote)
- Lokal programlama butonlari (Function, Up, Down, Store)
- LED parametre display
- Faz gösterge LED'leri

Güç Baglantisi
- 3 telli baglanti
- 6 telli baglanti (F1 modellerde)
- Bypass terminalleri (bypass durumunda korumalar devrededir)
- 18 Amp - 1574 Amp (3 Telli)
  27 Amp - 2361 Amp (6 Telli)
- 200VAC - 525VAC (V5 modellerde)
- 200VAC - 690VAC (V7 modellerde)

Ilave Özellikler
- IP42 veya IP54 (<253 Amp.)
- IP00 (>302 Amp.)
- Akim okuma
- Motor sicaklik okuma
- Ariza kayit hafizasi (son 8 ariza)
- Sekonder motor parametre grubu
- Restart gecikmesi
- Düsük akim ikazi
- Yüksek akim ikazi
- Motor sicaklik ikazi
- Auto-reset
- Auto-stop
- Start sayicisi
- Fonksiyon kilidi (Password)
- Yedekleme/çagirma fonksiyonu
- Acil durum modunda çalisma
- Termal modelleme iptali

2.3 Parça Numara Formati



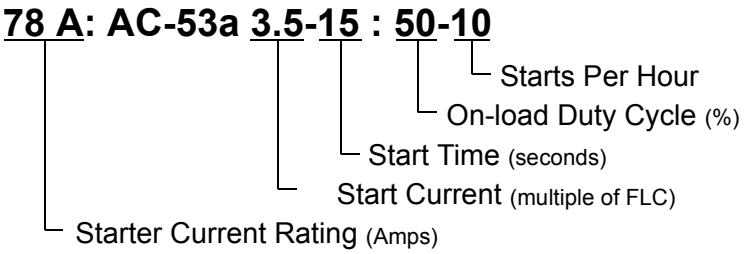
Section 3 Specifications

3.1 Current Ratings

Continuous Operation (Not bypassed)

	3.0 x FLC		3.5 x FLC		4.0 x FLC		4.5 x FLC	
	AC53a 3-10:50-10 45°C <1000 metres		AC53a 3.5-15:50-10 45°C <1000 metres		AC53a 4-20:50-10 45°C <1000 metres		AC53a 4.5-30:50-10 45°C <1000 metres	
	3 Wire	6 Wire	3 Wire	6 Wire	3 Wire	6 Wire	3 Wire	6 Wire
IMS20018	18	27	16	25	14	22	12	19
IMS20034	34	51	32	48	28	42	24	36
IMS20041	41	62	39	58	34	51	28	42
IMS20047	47	71	44	66	39	58	33	50
IMS20067	67	101	60	90	52	79	46	69
IMS20088	88	132	78	116	68	102	59	88
IMS20096	96	144	85	127	74	111	64	96
IMS20125	125	188	112	168	97	146	84	125
IMS20141	141	212	122	183	107	161	94	141
IMS20202	202	303	177	266	155	233	135	202
IMS20238	238	357	211	317	185	277	160	241
IMS20253	253	379	218	327	191	286	167	251
IMS20302	302	453	275	413	239	358	205	308
IMS20405	405	608	376	564	324	486	274	412
IMS20513	513	769	481	722	411	616	342	513
IMS20585	585	878	558	837	474	711	392	587
IMS20628	628	942	595	893	508	762	424	636
IMS20775	775	1163	756	1134	637	956	521	782
IMS20897	897	1346	895	1342	749	1123	604	906
IMS21153	1153	1730	1049	1574	917	1376	791	1187
IMS21403	1403	2105	1302	1953	1135	1703	970	1454
IMS21574	1574	2361	1486	2229	1290	1936	1091	1637

AC53a Utilisation Category Format



Starter Current Rating: The Full Load Current rating of the soft starter given the parameters detailed in the remaining sections of the utilisation code.

Start Current: The maximum available start current given the parameters detailed in the remaining sections of the utilisation code.

Start Time: The maximum available start time given the parameters detailed in the remaining sections of the utilisation code.

On-load Duty Cycle: The maximum permissible percentage of each operating cycle that the soft starter can operate given the parameters detailed in the remaining sections of the utilisation code.

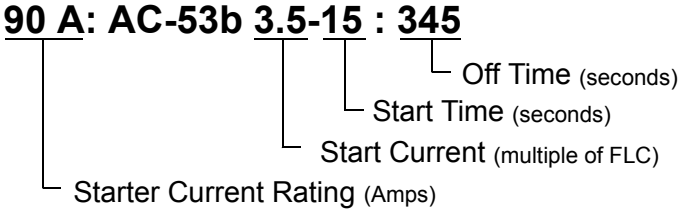
Starts Per Hour: The maximum available number of starts per hour given the parameters detailed in the remaining sections of the utilisation code.

Contact your local supplier for IMS2 ratings under operating conditions not covered by the above ratings charts.

Bypass Operation

	3.0 x FLC		3.5 x FLC		4.0 x FLC		4.5 x FLC	
	AC53b 3-10:350 45°C <1000 metres		AC53b 3.5-15:345 45°C <1000 metres		AC53b 4-20:340 45°C <1000 metres		AC53b 4.5-30:330 45°C <1000 metres	
	3 Wire	6 Wire	3 Wire	6 Wire	3 Wire	6 Wire	3 Wire	6 Wire
IMS20018	18	27	18	27	16	24	14	20
IMS20034	34	51	34	51	34	51	28	42
IMS20041	41	62	41	62	41	62	34	52
IMS20047	47	71	47	71	47	71	39	59
IMS20067	67	101	62	94	54	82	47	71
IMS20088	88	132	82	122	71	106	61	91
IMS20096	96	144	90	136	78	117	66	99
IMS20125	125	188	120	181	103	155	88	132
IMS20141	141	212	127	190	111	166	96	145
IMS20202	202	303	187	281	162	243	140	210
IMS20238	238	357	224	336	194	290	166	250
IMS20253	254	381	228	342	198	297	172	259
IMS20302	302	453	285	427	245	368	209	314
IMS20405	405	608	395	592	336	504	282	424
IMS20513	513	770	513	770	435	653	356	534
IMS20585	585	878	585	878	504	756	410	614
IMS20628	628	942	626	939	528	793	436	654
IMS20775	775	1163	775	1163	672	1009	542	813
IMS20897	897	1346	897	1346	798	1197	632	948
IMS21153	1153	1730	1153	1730	1006	1509	850	1276
IMS21403	1403	2105	1403	2105	1275	1912	1060	1591
IMS21574	1574	2361	1574	2361	1474	2212	1207	1811

AC53b Utilisation Category Format



Starter Current Rating: The Full Load Current rating of the soft starter given the parameters detailed in the remaining sections of the utilisation code.

Start Current: The maximum available start current given the parameters detailed in the remaining sections of the utilisation code.

Start Time: The maximum available start time given the parameters detailed in the remaining sections of the utilisation code.

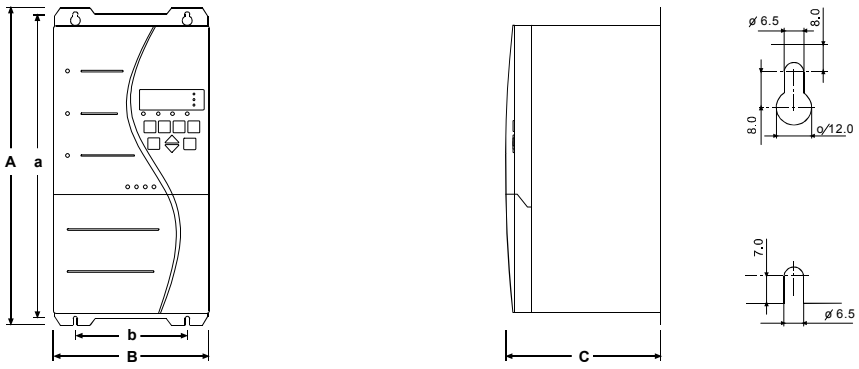
Off Time: The minimum allowable time between the end of one start and the beginning of the next start given the parameters detailed in the remaining sections of the utilisation code.

Contact your local supplier for IMS2 ratings under operating conditions not covered by the above ratings charts.

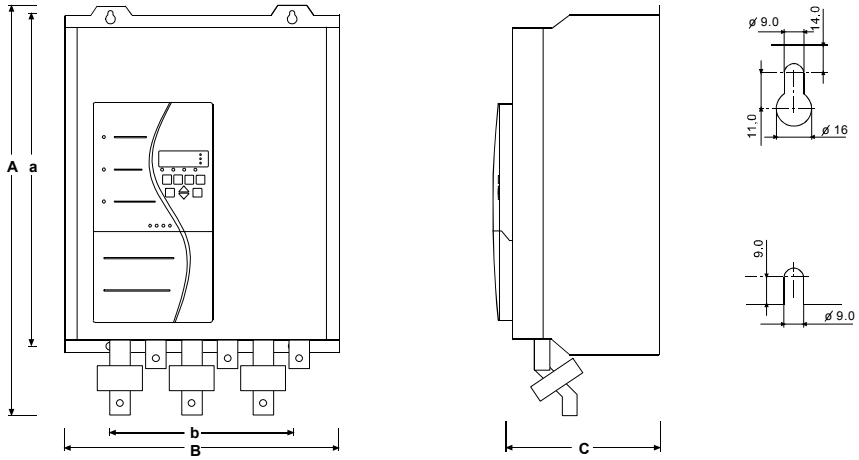
3.2 Dimensions & Weights

	A	B	C	a	b	Weight
	mm (inches)	mm (inches)	mm (inches)	mm (inches)	mm (inches)	Kg (lbs)
	IP42/NEMA 1 or IP54/NEMA12					
IMS20018 IMS20034 IMS20041 IMS20047	380 (14.96)	185 (7.28)	180 (7.09)	365 (14.37)	130 (5.12)	6 (13.2)
IMS20067 IMS20088 IMS20096 IMS20125	380 (14.96)	185 (7.28)	250 (9.84)	365 (14.37)	130 (14.37)	7 (15.4)
IMS20141 IMS20202 IMS20238	425 (16.73)	270 (10.63)	275 (10.83)	410 (16.14)	200 (7.87)	17.5 (38.6)
IMS20253	425 (16.73)	390 (15.35)	275 (10.83)	410 (16.14)	300 (11.81)	23 (50.7)
	IP00					
IMS20302 IMS20405 IMS20513 IMS20585	690 (27.16)	430 (16.93)	294 (11.58)	522 (20.55)	320 (12.60)	42 (92.6)
IMS20628 IMS20775 IMS20897						49 (108)
IMS21153 IMS21403 IMS21574	855 (33.27)	574 (22.60)	353 (13.90)	727 (27.83)	500 (19.68)	120 (242)

IMS20018 ~ IMS20253



IMS20302 ~ IMS21574



3.3 Semiconductor Fuses

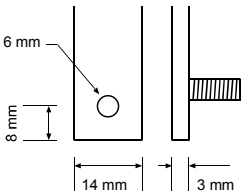
Semiconductor fuses can be used with the IMS2 to reduce the potential of damage to SCRs from transient overload currents and for Type 2 coordination. Suitable Bussman semiconductor fuses are detailed below.

F Series Fuses	Supply Voltage ≤415VAC	Supply Voltage ≤525VAC	Supply Voltage ≤575VAC	Supply Voltage ≤695VAC	Starter I^2t
IMS20018	63AFE	63AFE	63AFE	63AFE	1,150
IMS20034	160AFEE	160AFEE	160AFEE	160AFEE	10,500
IMS20041	200FM	180FM	180FM	180FM	15,000
IMS20047	200FM	180FM	180FM	180FM	18,000
IMS20067	200FM	180FM	180FM	180FM	15,000
IMS20088	250FM	250FM	250FM	250FM	51,200
IMS20096	250FM	250FM	250FM	250FM	80,000
IMS20125	250FM	250FM	250FM	250FM	97,000
IMS20141	280FM	280FM	280FM	280FM	97,000
IMS20202	500FMM	450FMM	450FMM	450FMM	145,000
IMS20238	630FMM	630FMM	630FMM	630FMM	414,000
IMS20253	630FMM	630FMM	630FMM	630FMM	414,000
IMS20302	630FMM	500FMM	500FMM	500FMM	211,000
IMS20405	500FMM	500FMM	500FMM	500FMM	320,000
IMS20513	700FMM	700FMM	700FMM	700FMM	781,000
IMS20585	*500FMM	*500FMM	*500FMM	*500FMM	1,200,000
IMS20628	*500FMM	*500FMM	*500FMM	*500FMM	1,200,000
IMS20775	*700FMM	*700FMM	*700FMM	*700FMM	2,532,000
IMS20897	-	-	-	-	4,500,000
IMS21153	-	-	-	-	4,500,000
IMS21403	-	-	-	-	6,480,000
IMS21574	-	-	-	-	12,500,000

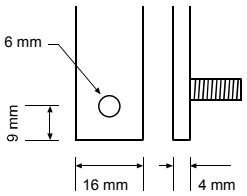
170M Fuses	Supply Voltage ≤415VAC	Supply Voltage ≤525VAC	Supply Voltage ≤575VAC	Supply Voltage ≤695VAC	Starter I^2t
IMS20018	170M1315	170M1314	170M1314	170M1314	1,150
IMS20034	170M1319	170M1317	170M1317	170M1317	10,500
IMS20041	170M1319	170M1318	170M1318	170M1318	15,000
IMS20047	170M1319	170M1318	170M1318	170M1318	18,000
IMS20067	170M1319	170M1318	170M1318	170M1318	15,000
IMS20088	170M3017	170M3017	170M3017	170M3017	51,200
IMS20096	170M1322	170M1321	170M1321	170M1321	80,000
IMS20125	170M1322	170M1322	170M1322	170M1322	97,000
IMS20141	170M1322	170M1322	170M1322	170M1322	97,000
IMS20202	170M6141	170M6141	170M6141	170M6141	145,000
IMS20238	170M3023	170M3023	170M3023	170M3023	414,000
IMS20253	170M3023	170M3023	170M3023	170M3023	414,000
IMS20302	170M5144	170M5144	170M5144	170M5144	211,000
IMS20405	170M6012	170M4016	170M6011	170M6011	320,000
IMS20513	170M6014	170M6014	170M4018	170M4018	781,000
IMS20585	170M5017	170M6015	170M6014	170M6014	1,200,000
IMS20628	170M6019	170M6018	170M6017	170M6017	1,200,000
IMS20775	170M6021	170M6020	170M6017	170M6017	2,532,000
IMS20897	170M6021	170M6020	170M6151	170M6151	4,500,000
IMS21153	170M6021	170M6020	170M6151	170M6151	4,500,000
IMS21403	170M6021	170M6021	*170M5018	*170M5018	6,480,000
IMS21574	170M6021	170M6021	*170M5018	*170M5018	12,500,000

* Two parallel connected fuses required per phase

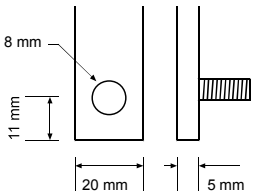
3.4 Power Terminations



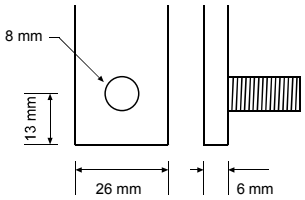
IMS20018~ IMS20047
(3.5 NM, 2.6 FT-LBS)



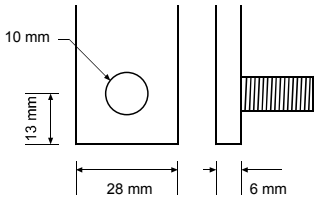
IMS20067~ IMS20125
(3.5 NM, 2.6 FT-LBS)



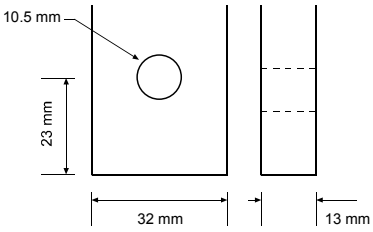
IMS20141
(8.5 NM, 6.3 FT-LBS)



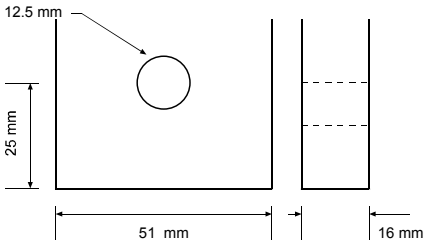
IMS20202~ IMS20238
(8.5 NM, 6.3 FT-LBS)



IMS20253
(17 NM, 12.5 FT-LBS)



IMS20302~ IMS20897



IMS21153~ IMS21574

3.5 General Technical Data

Supply	
Supply voltage IMS2xxxx-V5-xxx-xx-xx	3 x 200VAC ~ 525VAC (3 Wire Connection)
	3 x 200VAC ~ 440VAC (6 Wire Connection)
Supply voltage IMS2xxxx-V7-xxx-xx-xx	3 x 200VAC ~ 690VAC (3 Wire Connection)
	3 x 200VAC ~ 440VAC (6 Wire Connection)
Electronics Supply IMS2xxx-xx-C12-xx-xx	110VAC (+10%/-15%) or 230VAC (+10%/-15%)
Electronics Supply IMS2xxx-xx-C24-xx-xx	230VAC (+10%/-15%) or 400VAC (+10%/-15%)
Electronics Supply IMS2xxx-xx-C45-xx-xx	460VAC (+10%/-15%) or 575VAC (+10%/-15%)
Supply frequency (at start)	50Hz (± 2Hz) or 60Hz (±2Hz)
Supply frequency (during start)	> 45Hz (50Hz supply) or > 55Hz (60Hz supply)
Supply frequency (during run)	>48Hz (50Hz supply) or > 58Hz (60Hz supply)

Control Inputs	
Start (Terminals C23, C24)	Normally Open, Active 24VDC, 8mA approx.
Stop (Terminals C31, C32)	Normally Closed, Active 24VDC, 8mA approx.
Reset (Terminals C41, C42)	Normally Closed, Active 24VDC, 8mA approx.
Programmable Input A (Terminals C53, C54)	Normally Open, Active 24VDC, 8mA approx.

Outputs	
Run Output (Terminals 23, 24)	Normally Open, 5A @ 250VAC/360VA
	5A @ 30VDC resistive
Programmable Relay Output A (Terminals 13, 14)	Normally Open, 5A @ 250VAC/360VA
	5A @ 30VDC resistive
Programmable Relay Output B (Terminals 33, 34)	Normally Open, 5A @ 250VAC/360VA
	5A @ 30VDC resistive
Programmable Relay Output C (Terminals 41, 42, 44)	Changeover, 5A @ 250VAC/360VA
	5A @ 30VDC resistive
Analogue Output (Terminals B10, B11)	4-20mA

Sundry	
Enclosure Rating IMS2xxxx-xx-xxx-xx-E0	IP00 (Open Chassis)
Enclosure Rating IMS2xxxx-xx-xxx-xx-E4	IP42 (NEMA 1)
Enclosure Rating IMS2xxxx-xx-xxx-xx-E5	IP54 (NEMA 12)
Rated short-circuit current (with semiconductor fuses)	100kA
Rated insulation voltage	690V
Surges	2kV line to earth, 1kV line to line
Fast transients	2kV / 5kHz
Rated impulse withstand voltage	2kV
Form designation	Form 1
Electrostatic discharge	4kV contact discharge, 8kV air discharge
Equipment class (EMC)	Class A[1]
Radio-frequency electromagnetic field	0.15MHz - 80MHz: 140dBµV 80MHz - 1GHz: 10V/m
Pollution degree	Pollution Degree 3
Operating Temperatures	-5°C / +60°C
Relative Humidity	5 – 95% (max non condensing)

[1] This product has been designed for Class A equipment. Use of the product in domestic environments may cause radio interference, in which case the user may be required to employ additional mitigation methods.

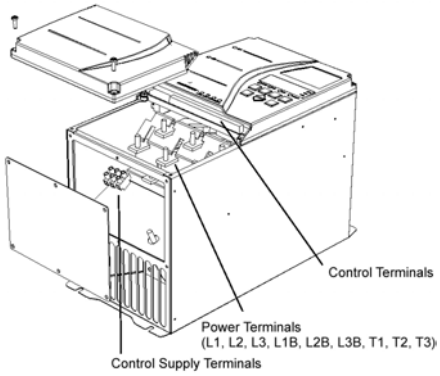
Standards Approvals	
CE	IEC 60947-4-2
UL / CUL[1]	UL508, CSA 22.2 No.14
C✓	AS/NZS 3947-4-2, CISPR-11

[1] Requires the use of semiconductor fuses; is applicable for supply voltages up to 600V; excludes models IMS21153 TO IMS21574.

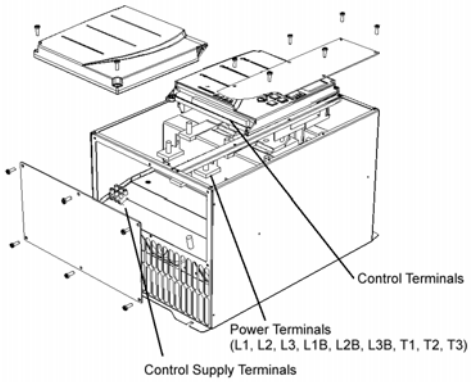
Section 4 Installation

4.1 General Layout Diagrams

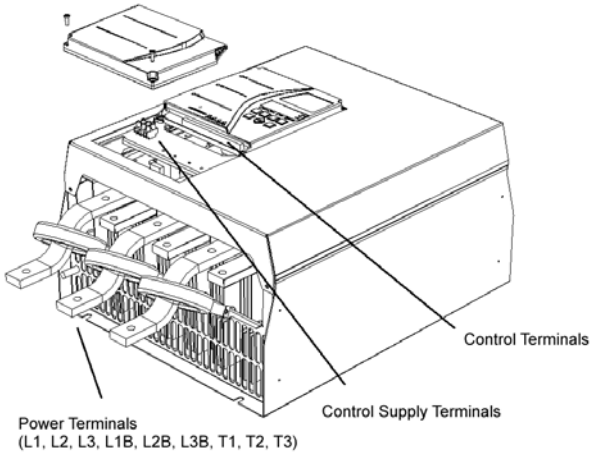
IMS20018 ~ 0125



IMS20141 ~ 0253

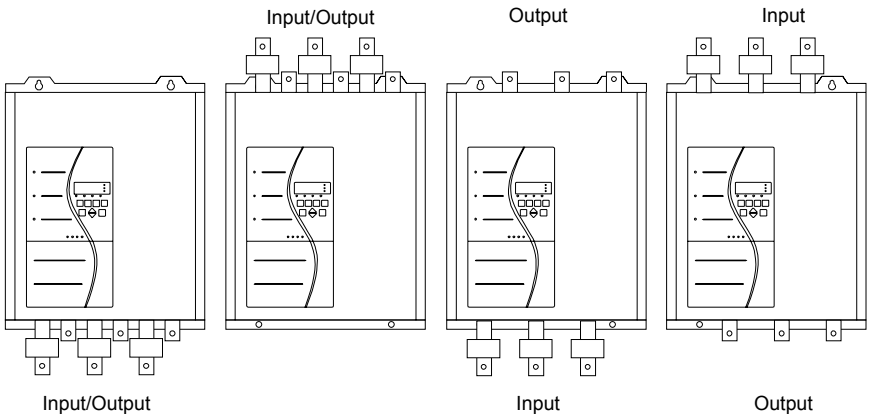


IMS20302 ~ 1574



4.2 Power Termination Configuration

The bus bars on models IMS20302 ~ 1574 can be adjusted to provide four different input/output power terminal configurations.



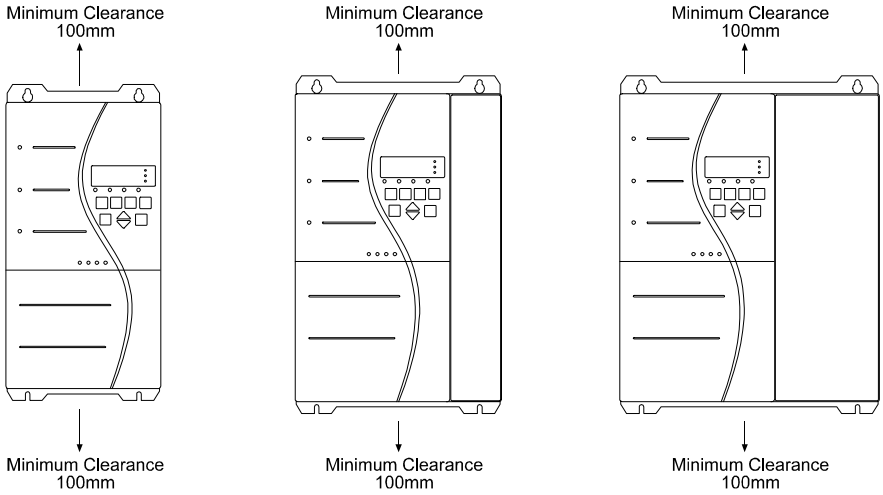
To adjust the bus bar configuration first remove the IMS2 covers and main control module. Next loosen and remove the bus bar fixing bolts. The bus bars can then be removed and reinstalled into the starter in the desired configuration. The fixing bolts should then be refitted and tightened to a torque of 8.5NM.

When re-orienting bus bars L1, L2, L3 the current transformers must also be relocated.

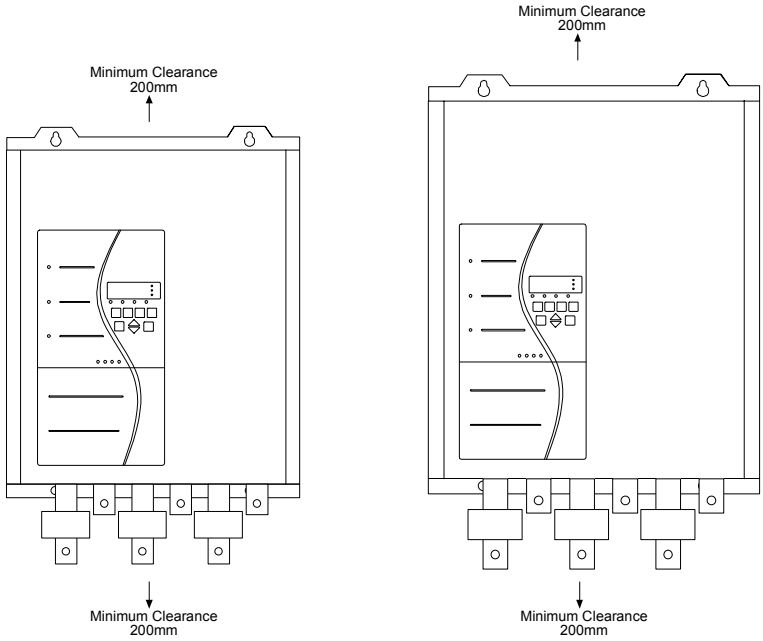
Care must be taken to ensure that foreign matter does not contaminate the jointing compound and become trapped between the bus bar and its mounting plate. If the paste does become contaminated, clean and replace with a jointing compound suitable for aluminium to aluminium, or aluminium to copper joints.

4.3 Mounting Instructions

Models IMS20018 ~ 0253 can be wall mounted or installed inside another enclosure. These models can be mounted side by side with no clearance but a 100mm allowance must be made top and bottom for air intake and exhaust.



Models IMS20302 ~ 1574 have an IP00 rating and must be mounted in another enclosure. These models can be mounted side by side with no clearance but a 200mm allowance must be made top and bottom for air intake and exhaust.



4.4 Ventilation

When installing IMS2 starters in an enclosure there must be sufficient air flow through the enclosure to limit heat rise within the enclosure. Temperature within the enclosure must be kept at, or below, the IMS2 maximum ambient temperature rating.

If installing an IMS2 within a totally sealed enclosure a bypass contactor must be employed to eliminate heat dissipation from the soft starter during run.

Soft starters dissipate approximately 4.5 watts per amp. The table below shows air flow requirements for selected motor currents. If other heat sources are installed in an enclosure along with the IMS2 an additional air flow allowance must be made for these items. Note that heat generation from semiconductor fuses, if used, can be eliminated by installing these within the bypass loop.

Motor Amps	Heat (watts)	Required Airflow			
		m^3/min		m^3/hour	
		5°C Rise	10°C Rise	5°C Rise	10°C Rise
10	45	0.5	0.2	30	15
20	90	0.9	0.5	54	27
30	135	1.4	0.7	84	42
40	180	1.8	0.9	108	54
50	225	2.3	1.1	138	69
75	338	3.4	1.7	204	102
100	450	4.5	2.3	270	135
125	563	5.6	2.8	336	168
150	675	6.8	3.4	408	204
175	788	7.9	3.9	474	237
200	900	9.0	4.5	540	270
250	1125	11.3	5.6	678	339
300	1350	13.5	6.8	810	405
350	1575	15.8	7.9	948	474
400	1800	18.0	9.0	1080	540
450	2025	20.3	10.1	1218	609
500	2250	22.5	11.3	1350	675
550	2475	24.8	12.4	1488	744
600	2700	27.0	13.5	1620	810

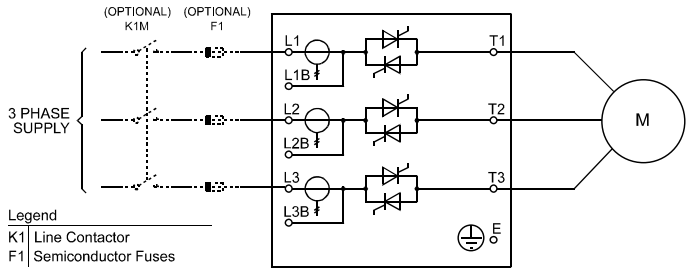
Section 5 Power Circuits

5.1 Overview

IMS2 starters can be wired with a number of different power circuits depending on application requirements.

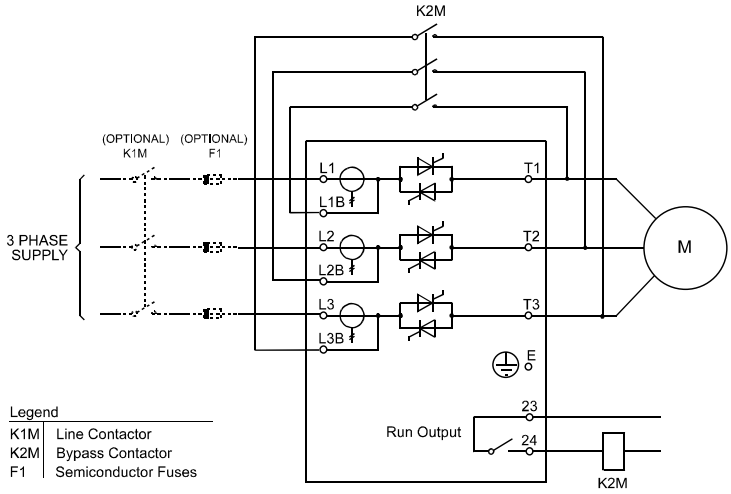
5.2 3 Wire Connection

This is the standard connection format. Supply voltage is connected to the starter input terminals L1, L2 & L3. The motor cables are connected to the soft starter output terminals T1, T2 & T3.



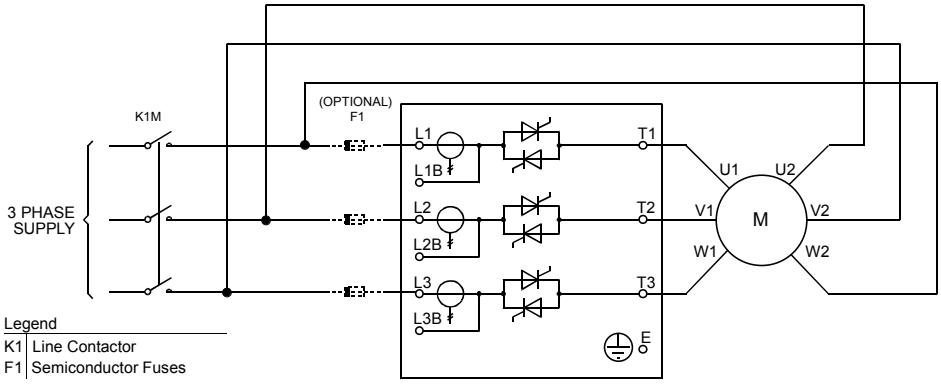
5.3 3 Wire Connection (Bypass Operation)

IMS2 starters can be bypassed while the motor is running. Special terminals (L1B, L2B, L3B) are provided for connection of the bypass contactor. Use of these terminals enables the IMS2 to continue to provide all protection and current monitoring functions even when bypassed.
The IMS2 Run Output (Terminals 23 & 24) should be used to control operation of the bypass contactor. The bypass contactor can be AC1 rated for the motor full load current.



5.4 6 Wire Connection

IMS2xxxx-xx-xxx-**F1**-xx units are capable of 6 Wire (Inside Delta) connection as well as 3 Wire connection. When connected in this configuration the soft starter carries only phase current. This means the motor FLC current can be 50% greater than the soft starter's FLC current rating.

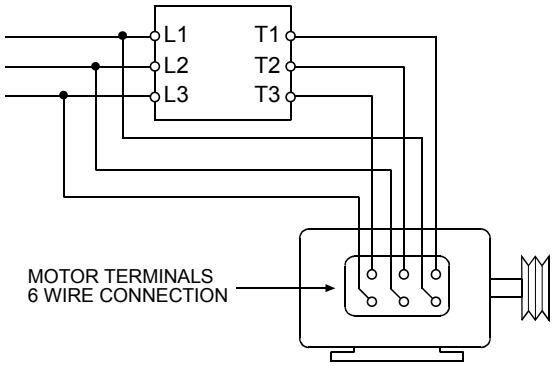


A motor usually has two rows of three terminals in the motor termination box.

If the motor windings are connected in delta, there will be three links fitted. Each link is connected from a terminal in the top row to one in the bottom row.
If the motor windings are connected in star, there will be one link fitted. This link is connected to all three terminals in one row.

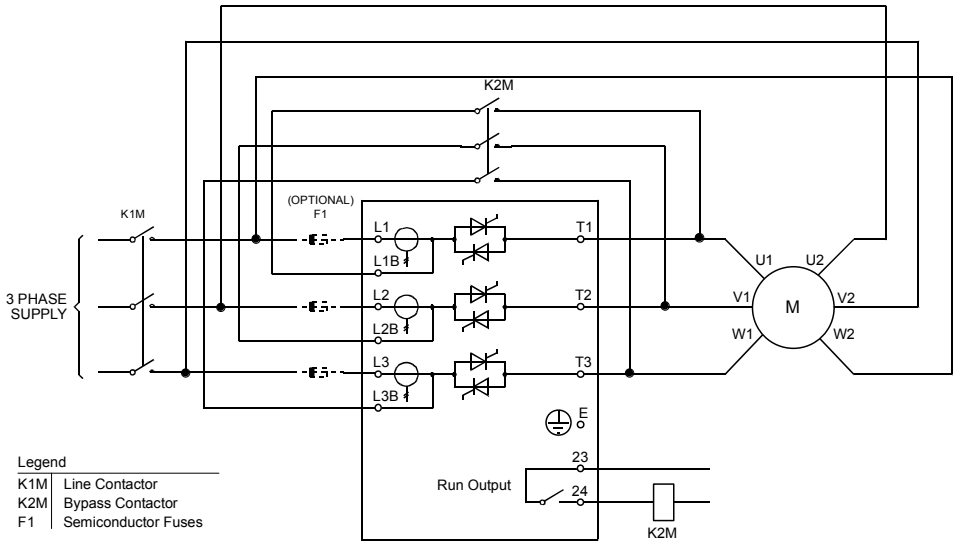
For 6 Wire connection, remove all links from the motor termination box. Connect the three output terminals of the IMS2 (T1, T2, T3) to one end of each motor winding. Connect the opposite end of each motor winding to a different phase on the input of the IMS2.

For example:
- Remove the links from the motor termination box.
- Connect the incoming phases to L1, L2, L3 on the IMS2.
- Connect each IMS2 output phase to one end of an individual motor winding: T1-U1, T2-V1, T3-W1.
- Connect the other end of each individual motor winding to a different phase on the input of the IMS2: U2-L2, V2-L3, W2-L1.



5.5 6 Wire Connection (Bypass Operation)

IMS2xxxx-xx-xxx-**F1**-xx units are capable of 6 Wire (Inside Delta) connection and can be bypassed.



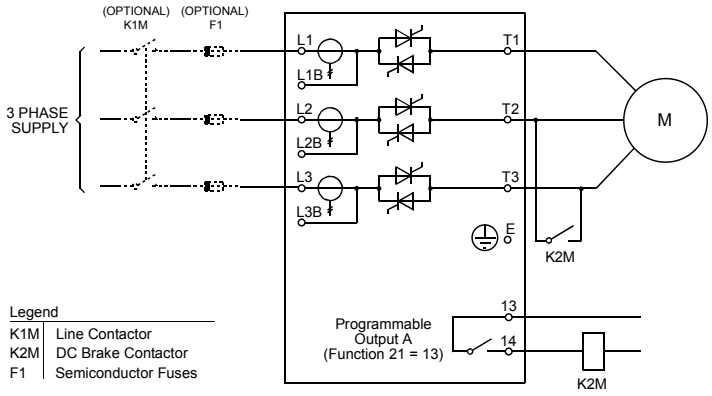
5.6 DC Braking

IMS2xxx-xx-xxx-**F2**-xx models provide a DC Brake function. The DC Brake function requires that a contactor with an AC1 rating greater than the FLC of the connected motor be wired between the output terminals T2 & T3 as shown in the electrical schematic below. The following functions must also be adjusted to activate the DC Brake function.

- Function 14 *DC Brake - Brake Time*
- Function 15 *DC Brake - Brake Torque*

- Function 21 *Relay Output A Functionality*

CAUTION:
The soft starter power modules will be damaged if the DC Brake contactor is closed when the DC Brake function is not operating, or if the DC Brake contactor is incorrectly wired between T1-T2 or T1-T3.



5.7 Power Factor Correction

If static power factor correction is employed, it must be connected to the supply side of the soft starter.

CAUTION:
Under no circumstance should power factor correction capacitors be connected between the soft starter and the motor. Connecting power factor correction capacitors to the output of the soft starter will result in damage to the soft starter.

5.8 Line Contactors

The IMS2 is designed to operate with or without a line contactor. In many regions there is a statutory requirement that a line contactor be employed with electronic motor control equipment. From a safety point of view, this is the preferable option, however is not necessary for starter operation. An additional benefit gained by use of a line contactor is isolation of the starter SCRs in the off state, when they are most susceptible to damage from voltage transients.

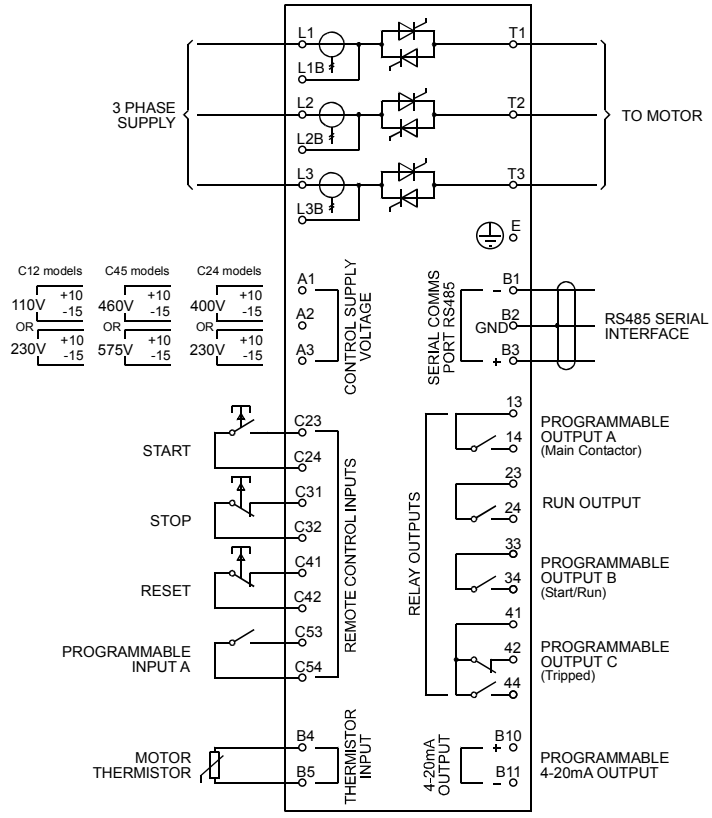
The IMS2 can directly control a line contactor via the Main Contactor control output.

As an alternative to a line contactor, either a circuit breaker with a no volt release coil operated by the IMS2 trip output, or a motor operated circuit breaker can be considered. If a motor operated circuit breaker is used as a line contactor, the potential delay between the breaker being told to close and phase power being applied to the IMS2 could cause the IMS2 to trip on installation faults. Closing the motorised breaker directly and using the breaker's auxiliary contacts, or preferably a slave relay with gold flash contacts, to control the IMS2, can avoid this.

Line contactors must be selected such that their AC3 rating is equal to or greater than the full load current rating of the connected motor.

Section 6 Control Circuits

6.1 Electrical Schematic



6.2 Control Supply

Voltage must be connected to the IMS2 control voltage terminals. The required control voltage is dependent upon the IMS2 model ordered.

- IMS2xxxx-xx-**C12**-xx-xx models: 110VAC (A1-A2) or 230VAC (A2-A3)
- IMS2xxxx-xx-**C24**-xx-xx models: 230VAC (A2-A3) or 400VAC (A1-A2)
- IMS2xxxx-xx-**C45**-xx-xx models: 460VAC (A1-A2) or 575VAC (A2-A3)

IMS2 Model	Maximum VA
IMS20018 ~ IMS20047	11VA
IMS20067 ~ IMS20125	18VA
IMS20141 ~ IMS20238	24VA
IMS20253 ~ IMS20897	41VA
IMS21153 ~ IMS21574	56VA

For circumstances where the available control supply voltage is not suitable for direct connection to the IMS2 the following range of auto-transformers are available as accessories. These auto-transformers can be mounted within the IMS2 in models up to IMS20253 and should be connected between the line voltage and IMS2 control supply input.

Input Voltages For C24 IMS2 Models	Part Number		
	IMS20018 ~ IMS20047	IMS20067 ~ IMS20238	IMS20253 ~ IMS21574
110 / 460VAC	995-00821-00	995-00823-00	995-00824-00
110 / 575VAC	995-00825-00	995-00827-00	995-00828-00

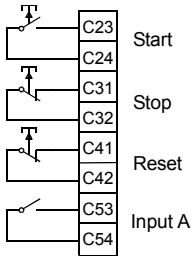
Input Voltages For C45 IMS2 Models	Part Number		
	IMS20018 ~ IMS20047	IMS20067 ~ IMS20238	IMS20253 ~ IMS21574
110 / 230VAC	995-00829-00	995-00831-00	995-00832-00

6.3 Control Wiring

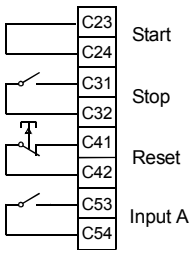
IMS2 operation can be controlled using either the local push buttons, remote control inputs or the serial communications link. The **<LOCAL/REMOTE>** push button can be used to switch between local and remote control. Refer to Function 20 *Local/Remote Operation* for details.

Remote Control Inputs.
The IMS2 has four remote control inputs. Contacts used for controlling these inputs should be low voltage, low current rated (gold flash or similar).

Remote push button control



Two wire control

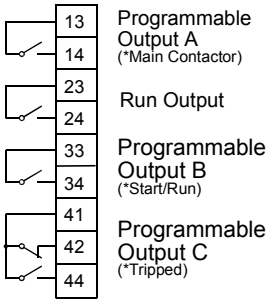


CAUTION:
Do not apply voltage to the control inputs. The inputs are active 24VDC and must be controlled with potential free circuits.

Ensure contacts/switches operating the control inputs are suitable for low voltage, low current switching, ie gold flash or similar.

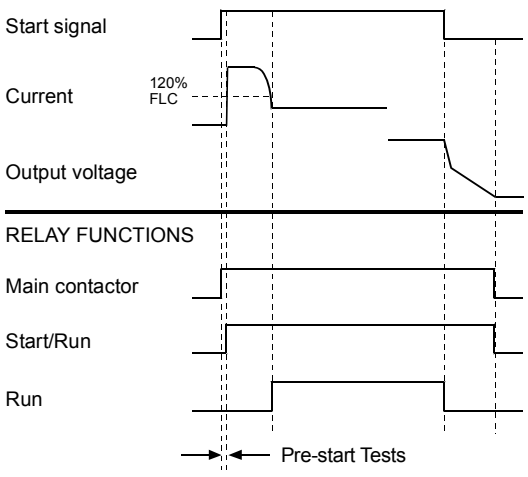
Ensure cables to the control inputs are segregated from AC power and control wiring.

Relay Outputs.
The IMS2 provides four relay outputs, one fixed and three programmable. Functionality of the programmable outputs is determined by the settings of Functions 21, 22 & 23.



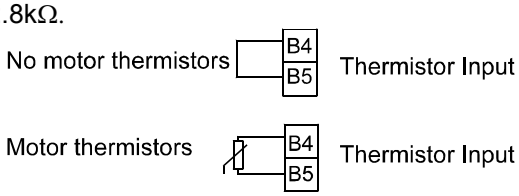
* = default functionality

Functionality Assignment
- Tripped
- Overcurrent trip
- Undercurrent trip
- Motor thermistor trip
- Starter overtemperature trip
- Phase imbalance trip
- Electronic shearpin trip
- Low current flag
- High current flag
- Motor temperature flag
- Start/Run
- Main contactor
- Auxiliary trip
- DC Brake contactor control (Output A only)



CAUTION:
Some electronic contactor coils are not suitable for direct switching with PCB mount relays. Consult the contactor manufacturer/supplier to see if this is advisable.

Motor Thermistors.
Motor thermistors (if installed in the motor) may be connected directly to the IMS2. A trip will occur when the resistance of the thermistor circuit exceeds approximately 2.8kΩ. The IMS2 can be reset once the thermistor circuit resistance falls below approximately 2.8kΩ.



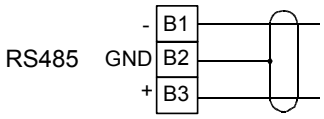
NOTE:
The thermistor circuit must be closed before the IMS2 will run.

The thermistor circuit should be run in screened cable and must be electrically isolated from earth and all other power and control circuits.

If no motor thermistors are connected to the IMS2 thermistor input there must be a link across the thermistor input terminals B4 & B5 or Function 34 *Motor Thermistor* must be set to 1 (Off).

6.4 RS485 Serial Communication

The IMS2 has a non-isolated RS485 serial communication link.



The serial link can be used to:
- Control IMS2 operation
- Query IMS2 status and operating data
- Read (download) function values from the IMS2
- Write (upload) function values to the IMS2

Three serial protocols are available: IMS2 ASCII, MODBUS RTU and MODBUS ASCII. Select the relevant protocol using Function 63 *Serial Protocol.*

NOTE:
Power cabling should be kept at least 300mm away from communications cabling. Where this cannot be avoided magnetic shielding should be provided to reduce induced common mode voltages.

The IMS2 can be programmed to trip if the RS485 serial link fails. This is done by setting Function 60 *Serial Time Out.*
Baud rate is set by Function 61 *Serial Baud Rate*.
The starter address is assigned using Function 62 *Serial Satellite Address*.

NOTE:
Slave address must be two digit, addresses less than 10 must have a leading zero (0).

NOTE:
The IMS2 may take up to 250ms to respond. The host software timeout should be set accordingly.

NOTE:
The satellite address and baud rate may also be altered through the serial interface. Behaviour of the serial interface will not be affected by

such function value changes until the current Serial Programming mode session is terminated by the master. The serial master application must ensure that altering these function values does not cause communication problems.

6.5 IMS2 ASCII Protocol

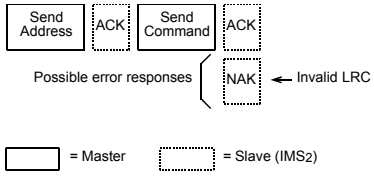
The details of the message fragments used in communicating with the IMS2 are shown in the table below. The message fragments may be assembled into complete messages as described in the sections that follow.

NOTE:
Data transmitted to and from the IMS2 must be in 8 bit ASCII, no parity, 1 stop bit.

Message Fragment Type	ASCII Character String or (Hexadecimal Character String)
Send Address	EOT [nn] [lrc] ENQ or (04h [nn] [lrc] 05h)
Send Command	STX [ccc] [lrc] ETX or (02h [ccc] [lrc] 03h)
Send Request	
Read Function Values	
Write Function Values	
Receive Data	STX [dddd] [lrc] ETX or (02h [dddd] [lrc] 03h)
Receive Status	STX [ssss] [lrc] ETX or (02h [ssss] [lrc] 03h)
Function Number	DC1 [pppp] [lrc] ETX or (011h [pppp] [lrc] 03h)
Function Value	DC2 [vvvv] [lrc] ETX or (012h [vvvv] [lrc] 03h)
ACK	ACK or (06h)
NAK	NAK or (15h)
ERR	BEL or (07h)

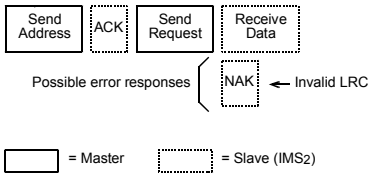
nn = two byte ASCII number representing the soft starter address where each decimal digit is represented by n.
lrc = two byte longitudinal redundancy check in hexadecimal.
ccc = three byte ASCII command number where each character is represented by c.
dddd = four byte ASCII number representing the current or temperature data where each decimal digit is represented by d.
ssss= four byte ASCII number. The first two bytes are ASCII zero. The last two bytes represent the nibbles of a single byte of status data in hexadecimal.
pppp = four byte ASCII number representing the function number where each decimal digit is represented by p.
vvvv = four byte ASCII number representing the function value where each decimal digit is represented by v.

Commands.
Commands can be sent to the IMS2 using the following format:



Command	ASCII	Comment
Start	B10	Initiates a start
Stop	B12	Initiates a stop
Reset	B14	Resets a trip state
Coast to stop	B16	Initiates an immediate removal of voltage from the motor. Any soft stop or DC Brake settings are ignored.

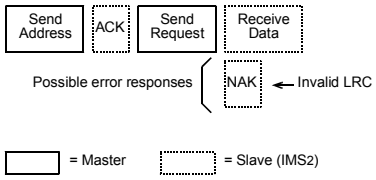
Status retrieval.
Starter status can be retrieved from the IMS2 using the following format:



Request	ASCII	Receive Data (ssss)	
Version	C16	Serial protocol version number.	
Trip Code	C18	Requests the trip status of the IMS2. 255 = No trip 0 = Shorted SCR 1 = Excess start time 2 = Motor thermal model 3 = Motor thermistor 4 = Phase imbalance 5 = Supply frequency 6 = Phase sequence 7 = Electronic shearpin 8 = Power circuit fault 9 = Undercurrent 10 = Heatsink overtemperature (F) 11 = Invalid motor connection (P) 12 = Auxiliary input (J) 13 = Out of range FLC (L) 14 = Incorrect main control module (Y)	
Product Version	C20	**Bit No.**	**Description**
		0 - 2	Function list version
		3 - 7	Starter type (2 = IMS2)
Starter Status	C22	**Bit No.**	**Description**
		0 - 3	0 = Not used 1 = Waiting 2 = Starting (incl. Pre-start tests) 3 = Running 4 = Stopping 5 = Restart delay 6 = Tripped 7 = Programming mode
		4	1 = Positive phase sequence detected
		5	1 = Current exceeds the FLC
		6	0 = Uninitialised 1 = Initialised *nb: bit 4 is not valid unless bit 6 = 1*
		7	Unallocated

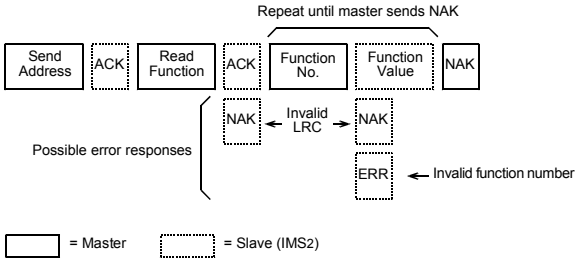
NOTE:
The IMS2 command set has changed. The current version is backwards compatible with older functions. Refer to previous User Manuals, if required.

Data retrieval.
Data can be retrieved from the IMS2 using the following format:



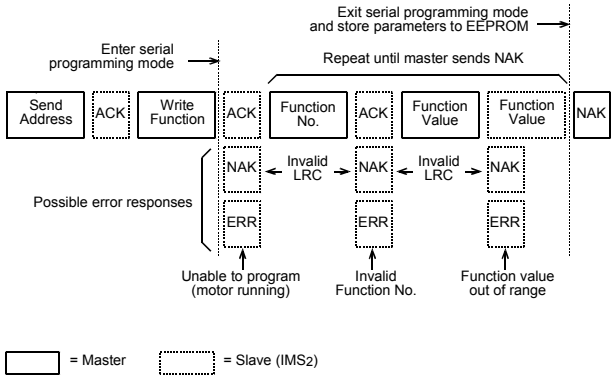
Request	ASCII	Receive Data (dddd)
Current	D10	Requests motor current. The data is 4 byte decimal ASCII. Minimum value 0000, Maximum value 9999 amps.
Temperature	D12	Requests the calculated value of the motor thermal model as a % of Motor Thermal Capacity. The data is 4 byte decimal ASCII. Minimum value 0000%. Trip point 0105%.

Download function values from the IMS2.
Function values may be downloaded from the IMS2 at any time using the following format:



Read Functions	ASCII	Comment
Download Functions	P10	Readies IMS2 to download function values.

Upload function values to the IMS2.
Function values may be uploaded to the IMS2 only when it is in the off state, ie not starting, running, stopping or tripped. Use the following format to upload function values:



Write Functions	ASCII	Comment
Upload Functions	P12	Readies IMS2 to upload function values.

When the IMS2 receives an Upload Functions command it enters the Serial Programming mode. When in the Serial Programming mode the IMS2 local push buttons and remote inputs are inoperative, the serial start command is unavailable and the IMS2 numeric display flashes the letters ‘SP’.

When the Upload Functions command is terminated by the master or with an error or with a timeout, the Functions are written to the EEPROM and the IMS2 exits the Serial Programming mode.

NOTE:
The Serial Programming mode will timeout in 500ms if there has been no serial activity.

NOTE:
The following functions may not be adjusted: Function 100, 101, 102, 103, 110, 113 & 117. If values for these functions are uploaded to the IMS2 there will be no effect and no error generated.

Calculating the check sum (LRC).
Each command string sent to and from the IMS2 includes a check sum. The form used is the Longitudinal Redundancy Check (LRC) in ASCII hex. This is an 8-bit binary number represented and transmitted as two ASCII hexadecimal characters.

To calculate LRC:
1. Sum all ASCII bytes
2. Mod 256
3. 2's complement
4. ASCII convert

For example Command String (Start):

ASCII	STX	B	1	0
or	02h	42h	31h	30h

ASCII	Hex	Binary	
STX	02h	0000 0010	
B	42h	0100 0010	
1	31h	0011 0001	
0	30h	0011 0000	
	A5h	1010 0101	SUM (1)
	A5h	1010 0101	MOD 256 (2)
	5Ah	0101 1010	1's COMPLEMENT
	01h	0000 0001	+ 1 =
	5Bh	0101 1011	2's COMPLEMENT (3)
ASCII	5	B	ASCII CONVERT (4)
or	35h	42h	LRC CHECKSUM

The complete command string becomes

ASCII	STX	B	1	0	5	B	ETX
or	02h	42h	31h	30h	35h	42h	03h

To verify a received message containing an LRC:
1. Convert last two bytes of message from ASCII to binary.
2. Left shift 2nd to last byte 4 bits.
3. Add to last byte to get binary LRC.
4. Remove last two bytes from message.
5. Add remaining bytes of message.
6. Add binary LRC.
7. Round to one byte.
8. The result should be zero.

Response or status bytes are sent from the IMS2 as an ASCII string.

STX [d1]h [d2]h [d3]h [d4]h LRC1 LRC2 ETX
d1 = 30h
d2 = 30h
d3 = 30h plus upper nibble of status byte right shifted by four binary places.
d4 = 30h plus lower nibble of status byte.

For example status byte = 1Fh, response is
STX 30h 30h 31h 46h LRC1 LRC2 ETX

6.6 MODBUS Protocols

Protocol options are available for MODBUS RTU and MODBUS ASCII.

The relevant protocol is selected using Function 63 *Serial Protocol*.
MODBUS Parity is set by Function 64 *MODBUS Parity*.

All the functionality of the IMS2 serial protocol (see previous section) is implemented in the MODBUS RTU & ASCII protocols using the MODBUS register structure as follows.

NOTE:
1. Command, Starter Status, Trip Code, Current or Temperature must be sent individually, ie one data word request at a time.
2. The MODBUS ASCII protocol is restricted to transferring 1 function at a time.
3. The MODBUS RTU protocol is restricted to transferring a maximum of 6 functions at a time.

Refer to the MODBUS standard at http://www.modbus.org for full details on the MODBUS protocol.

Register Address	Function	Type	Description	
40002	Command	Write	1 = Start 2 = Stop 3 = Reset 4 = Quick stop	
40003	Starter Status	Read	**Bit No.**	**Description**
			0 - 3	0 = Not used 1 = Waiting 2 = Starting (incl. Pre-start tests) 3 = Running 4 = Stopping 5 = Restart delay 6 = Tripped 7 = Programming mode
			4	1 = Positive phase sequence detected
			5	1 = Current exceeds the FLC
			6	0 = Uninitialised 1 = Initialised *nb: bit 4 is not valid unless bit 6 = 1*
			7	Unallocated
40004	Trip Code	Read	255 = No trip 0 = Shorted SCR 1 = Excess start time 2 = Motor thermal model 3 = Motor thermistor 4 = Phase imbalance 5 = Supply frequency 6 = Phase sequence 7 = Electronic shearpin 8 = Power circuit fault 9 = Undercurrent 10 = Heatsink overtemperature (F) 11 = Invalid motor connection (P) 12 = Auxiliary input (J) 13 = Out of range FLC (L) 14 = Incorrect main control module (Y)	

Register Address	Function	Type	Description
40005	Current	Read	
40006	Temperature	Read	
40009 to 40125	Function 1 to Function 117	Read / Write	Refer Section 7.2 *Function Descriptions* for detail

MODBUS HEX functions.
Two functions are supported: 03 Multiple read
06 Single write
The IMS2 does not accept broadcast functions.

Examples of MODBUS protocol.
Command:
Start

Write	Starter Address	Address	Data	Checksum
06	20	40002	1	(LRC or CRC)

Starter Status:
Starter Running

Read	Starter Address	Address	Data	Checksum
03	20	40003	xxxx0011	(LRC or CRC)

Trip Code:
Overcurrent Trip

Read	Starter Address	Address	Data	Checksum
03	20	40004	00000010	(LRC or CRC)

Read Function from the Soft Starter:
Read from Function 3 Initial Start Current, 350%

Read	Starter Address	Address	Data	Checksum
03	20	40011	350	(LRC or CRC)

Write Function to the Soft Starter:
Write to Function 12 Soft Stop Mode, set = 1 (Pump Control)
Note: Returns error if out of range

Write	Starter Address	Address	Data	Checksum
06	20	40020	1	(LRC or CRC)

Section 7 Programming

7.1 Programming Procedure

Step 1. Enter the program mode and select the function number to be viewed or adjusted.

1. Press and hold the **<FUNCTION>** key.
2. Use the **<UP>** and **<DOWN>** keys to select the required function number. (Function numbers are left justified and blink).
3. When the required function number is displayed, release the **<FUNCTION>** key. The display changes to show the function set point currently stored in memory. (Function values are right justified and do not blink).

Step 2. Alter the function set point.

1. Review the current function set point and if necessary, use the **<UP>** and **<DOWN>** keys to adjust the setting. (Pressing the **<FUNCTION>** key will restore the original setting).

Step 3. Store the new function set point.

1. Press the **<STORE>** key to store the displayed setting into memory.
2. Verify the new set point has been correctly stored by pressing and then releasing the **<FUNCTION>** key. The LED display should now show the new set point.

Step 4. Exit programming mode.

1. Once all function settings have been made, exit the programming mode by using the **<FUNCTION>** and **<DOWN>** keys to select function number 0 (RUN MODE).

7.2 Fonksiyon Listesi

No.	Fonksiyon	Fabrika Ayari	Kullanici Set 1	Kullanici Set 2
	Primer Motor Parametreleri			
1	Motor tam yük akimi	-		
2	Akim limiti	350		
3	Ilk startlama akimi	350		
4	Start rampa zamani	1		
5	Stop rampa zamani	0		
6	Motor start zaman sabiti	10		
7	Faz dengesizlik hassasiyeti	5		
8	Düsük akim korumasi	20		
9	Elektronik shearpin koruma	400		
	Start/Stop Formatlari			
10	Tork kontrol	0		
11	Kickstart (boost	0		
12	Soft stop modu	0		
13	Auto-stop-Run zamani	0		
14	DC Fren - Fren zamani	0		
15	DC Fren - Fren Torqu	30		
	Starter Fonksiyonlari			
20	Local/Remote çalisma	0		
21	Röle çikis A fonksiyonalitesi	11		
22	Röle çikis B fonksiyonalitesi	10		
23	Röle çikis C fonksionalitesi	0		
24	Giris A fonksiyonalitesi	0		
	Koruma Ayarlari			
30	Asiri yolalma zamani	20		
31	Faz sirasi	0		
32	Restart gecikmesi	1		
33	Faz dengesizligi	0		
34	Motor termistor	0		
35	Starter asiri isinma	0		
36	Yardimci açtirma modu	0		
	Set Noktalari			
40	Düsük akim ikazi	50		
41	Yüksek akim ikazi	105		
42	Motor sicaklik ikazi	80		
43	Saha Kalibrasyonu	100		
	Analog Çikis			
50	4-20mA output fonksiyonu	0		
51	4-20mA output araligi- max	100		
52	4-20mA output araligi -min	0		
	Seri Komünikasyon			
60	Seri zaman asimi	0		
61	Seri baud orani	4		
62	Seri adresleme	20		
63	Seri protokol	1		
64	MODBUS paritesi	0		
	Auto-Reset			
70	Auto-reset - konfigurasyonu	0		
71	Auto-reset - reset adedi	1		

	Fonksiyon	Fabrika Ayari	Kullanici Set 1	Kullanici Set 2
	Auto-Reset (devam)			
72	Auto-reset - group A & B gecik.	5		
73	Auto-reset - group C gecikmesi	5		
	Sekonder Motor Parametreleri			
80	Motor tam yük akimi	-		
81	Akim limiti	350		
82	Ilk startlama akimi	350		
83	Start rampa zamani	1		
84	Stop rampa zamani	0		
85	Motor start zaman sabiti	10		
86	Faz dengesizlik has.	5		
87	Düsük akim korumasi	20		
88	Elektronik shearpin koruma	400		
90	Faz dengesizlik açma gecikme	3		
91	Düsük akim açma gecikmesi	5		
92	Elektronik shearpin gecikmesi	0		
93	Frekans hatasi açma gecikmesi	0		
94	Yardimci açtirma gecikmesi	0		
	Yalnizca Okunur Bilgiler			
100	Model Numarasi	-		
101	Start sayicisi (1000'ler)	-		
102	Start sayicisi (1's)	-		
103	Trip Log	-		
	Güvenlik Fonksiyonlari			
110	Giris kodu	0		
111	Giris kodu güncelleme	0		
112	Fonksiyon kilidi	0		
113	Restore fonksiyon ayarlari	0		
114	Acil durum modu - format	0		
115	Acil durum modu - açma gecik.	0		
116	Termal model - manuel ayarlama	-		
117	Termal model - man.ayar adedi	-		

Uygulama Detaylari	
IMS2 model	
IMS2 seri numarasi	
IMS2 baglanti formati (tick)	☐ 3 Wire ☐ 6 Wire ☐ Bypass
Motor amp	
Motor kW	kW
Sürülen makine	
Start akimi (%FLC)	FLC
Start zamani (saniye)	sn.
Start/ saat	
Çevre sicakligi (°C)	°C
Uygulama Referansi	

Eger devreye alma sirasinda destek talep edilirse yukaridaki tabloyu doldurarak Koneksis Elektronik Kontrol ve Otomasyon Sistemleri Ltd'a fakslayiniz.

7.3 Fonksiyon Tanimlari

1. Motor Tam Yük Akimi [Primer Motor Ayari]

Aralik: **Modele Bagli (amp.)**

FabrikaAyari: **Modele Bagli (amp.)**

Tanim

IMS2'nin baglanacagi ve besleyecegi motorun tam yük akimidir (FLC yada In).

Ayar

Motor plakasinda yazili tam yük akimini (FLC/full load current/ampere) giriniz.

---

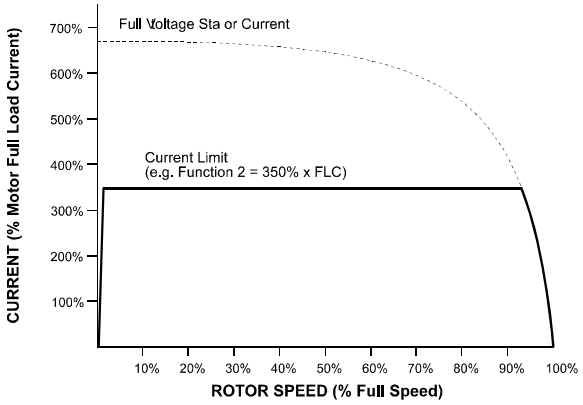
2. Akim Limiti [Primer Motor Ayarlari]

Aralik: **100 – 550 % FLC**

FabrikaAyari: **350% FLC**

Tanim

Sabit akim start modu için akim limitini ayarlar.



Ayar

Akim Limiti fonksiyonu için gerekli ayarlama kurulum tipine baglidir ve su kriterlere dikkat edilerek yapilmalidir :

- Motor yeterli start akimi ile yolalabilmeli ve bagli oldugu yüke kolay ivme saglayacak torku rahatlikla üretecek düzeyde endüklenebilmelidir.
- Arzu edilen start performansi elde edilebilmelidir.
- IMS2 güç araligi sinirlari geçilmemelidir.

---

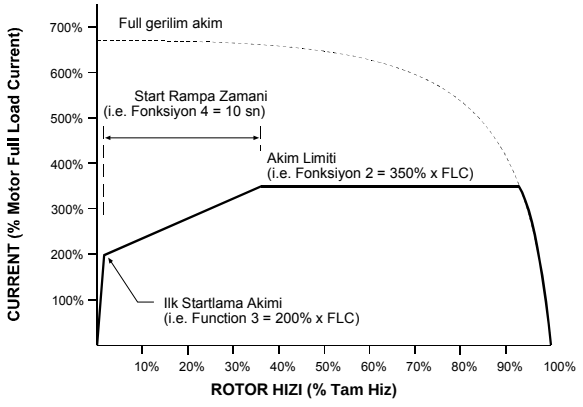
3. Ilk Startlama Akimi [Primer Motor Ayarlari]

Aralik: **100 – 550 % FLC**

FabrikaAyari: **350% FLC**

Tanim

Akim rampasi start modu için ilk start akim seviyesini ayarlar.



Ayarlama

Fonksiyon 3 *Ilk Startlama Akimi* ve Fonksiyon 4 *Start Rampa Zamani* akim rampa start modunu active etmek ve kontrol etmek için birlikte kullanilir.

Eger akim rampa start modu gerekiyorsa, Ilk Startlama akimini öyle ayarlayiniz ki motor start verildigi anda hemen ivmelenebilsin. Eger akim rampa start modu kullanmak gerekmiyorsa,ilk startlama akimini, akim limitine esit seciniz .

Akim Rampa start modunun sabit akim start moduna tercih edilmesi gereken uygulamalar örnek olarak kisaca :

- Gerekli start torqunun her startlamada degistigi uygulamalar. Örnegin konveyörler bazen yüklü bazen yüksüz kalkar. Bu durumda Fonksiyon 3 ilk *start akimini* motorun hafif yüklü durumdaki kalkisi için ve Fonksiyon 2 akim limitini motorun *agir yüklü durumdaki kalkisi için kullaniniz* .
- Pompalar gibi startlama zamaninin uzatilmasi gerekebilen degisken yük tipinde uygulamalar.
- Generator gruplari gibi sinirli güç ve nispeten yavas cevap veren yük uygulamalari (generatör grubunun cevabinin daha uzun süre gerektirmesi nedeniyle).

---

4. Start Rampa Zamani [Primer Motor Ayarlari]

Aralik	FabrikaAyari
1 – 30 Saniye	**1 Saniye**

Tanim

Akim rampa start modu için rampa zamanini ayarlar.

Ayarlama

Startlama performansini optimize etmek için start rampa zamanini ayarlayiniz.

---

5. Stop Rampa Zamani [Primer Motor Ayarlari]

Aralik	Fabrika Ayari
0 – 100 Saniye	**0 Saniye (Off)**

Tanim

Motorun yumusak durus yapmasi için Soft Stop Rampa zamanini ayarlar.

Ayarlama

Motorun istenilen stop performansini elde etmek için stop rampa zamanini ayarlayin.

IMS2 ile iki degisik soft stop modu elde edebilirsiniz. Fonksyion 12 *Soft Stop Modu* ile standart soft stop yada özel pompa durusu tercihleri yapilabilmektedir.

Eger Soft Stop fonksiyonu ile bir hat kontaktörü kullanilacaksa, kontaktör stop rampa zamaninin bitimine kadar kesinlikle açilmamalidir.IMS2 programlanabilir A,B yada C çikislari hat kontaktörünün kumandasi için kullanilabilir. Programlanabilir çikis detaylari için bakiniz : Fonksiyon 21 ,22, 23.

---

6. Motor Start Zaman Sabiti [Primer Motor Ayarlari]

Aralik	FabrikaAyari
0 – 120 Saniye	**10 Saniye**

NOT:
Bu ayar 0 saniye olarak girilirse IMS2 motor termal modellemesi iptal olur. Bu ayari yalnizca baska bir tür motor korumasi mevcutsa yapin.

Tanim

IMS2 motor termal modelleme algoritmasinca kullanilan motor termal kapasitesini ayarlar.

Ayarlama

Motor Start Zaman Sabitini (MSTC) motor'un termal kapasitesine göre ayarlayiniz.

A motor's thermal capacity is expressed as the maximum time (seconds) a motor can maintain locked rotor current conditions from cold, and is often referred to as Maximum Locked Rotor Time or Maximum DOL Start Time. This information is available from the motor data sheet or direct from the motor supplier.

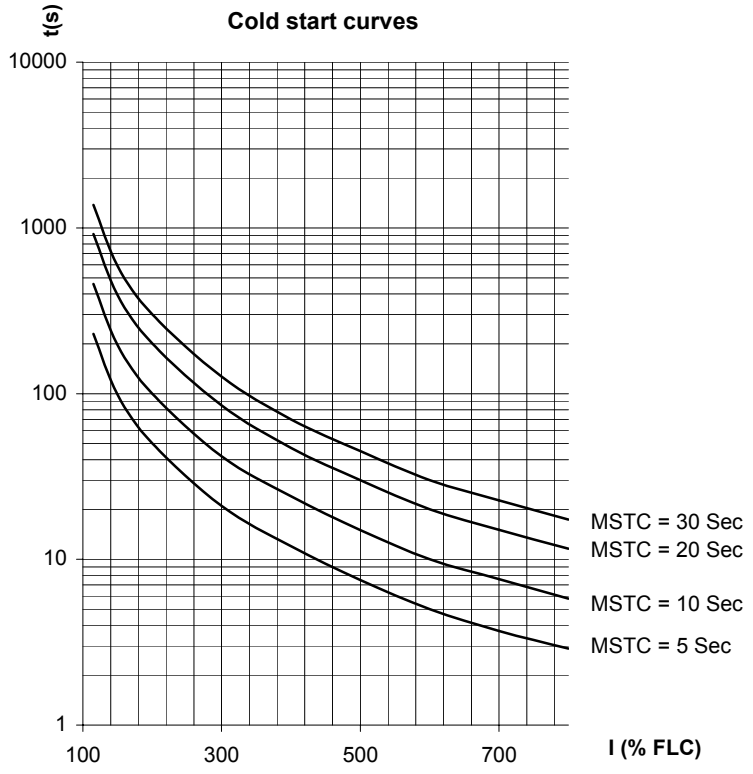
NOTE:
The IMS2 motor thermal model assumes a locked rotor current of 600%. If the connected motor's locked rotor current differs from this, greater accuracy can be achieved by using a normalised MSTC figure. A normalised MSTC figure can be calculated as follows:

$$\text{MSTC} = \left(\frac{\%\text{LRC}}{600}\right)^2 \text{X Max Start Time}$$

NOTE:
Setting Function 6 *Motor Start Time Constant* according to the motor's actual thermal capacity allows safe use of the motor's full overload capability both to start the load and ride through overload conditions. Additionally, a more conservative approach can be taken by setting a reduced MSTC for easy to start loads that will not experience transient operating overloads as a part of normal operation.

Using a reduced MSTC figure has the advantage of maximising motor life. The life of a motor is strongly influenced by its maximum winding temperature, with a 'rule of thumb' stating that the expected life span of a motor is halved for every ten degree rise in temperature. The temperature rise is dependent on the motor losses and the motor cooling. The highest stress on the motor is during start, and can be minimised by restricting the duration and frequency of starts. A reduced MSTC setting (Function 6) will also cause the IMS2 protection to operate before the motor is thermally stressed.

A suitable reduced MSTC figure can be established by observing the modelled motor temperature as shown on the IMS2 LED display, and adjusting the MSTC parameter such that after a normal start which has been preceded by a period of running at maximum load, the calculated motor temperature is approaching 90%.



7. FazDengesizlik Hassasiyeti [Primer Motor Ayarlari]

Aralik: **1 – 10**
FabrikaAyari: **5 (Normal hassasiyet)**

1 = En fazla hassasiyet (en az dengesizlik)
|
5 = Normal hassasiyet
|
10 = En az hassasiyet (en fazla dengesizlik)

Tanim

Faz dengesizligi korumasinin hassasiyetini ayarlar.

Ayarlama

Fabrika ayari pek çok uygulama için uygun olmakla birlikte özel uygulamalar için bu ayari kullanabilirsiniz.

8. DüsükAkim [Primer Motor Ayarlari]

Aralik: **0% – 100% FLC**
FabrikaAyari: **20% FLC**

Tanim

IMS2 düsük akim korumasinin açma noktasini, motor tam yük akiminin yüzdesi olarak ayarlar.

Ayarlama

Motor'un normal çalisma araliginin altinda ve motor'un miknatislanma akiminin (yüksüz ve tipik olarak tam yük akiminin 25% - 35% kadari) üstünde bir deger seçin.

0% degeri bu ayari devre disi birakir.

NOT:
Düsük akim koruma fonksiyonu sadece motor çalisirken aktiftir.

9. Elektronik Shearpin Korumasi [Primer Motor Ayarla

Aralik: **80% – 550% FLC**
FabrikaAyari: **400% FLC**

Tanim

IMS2 Elektronik Shearpin korumasinin açma noktasini, motor tam yük akiminin yüzdesi olarak ayarlar.

Ayarlama

Gerekli ayarlamayi yapiniz.

NOT:
Elektronik Shearpin Korumasi sadece motor çalisirken aktiftir.Bu koruma Fonksiyon 92 *Elektronik Shearpin gecikme süresi dolduktan sonra* çalisir.

10. Torque Control [Start/Stop Formatlari]

Aralik: **0 – 1**
FabrikaAyari: **0 (Off)**

0 = Off
1 = On

Tanim

Torque Kontrol fonksiyonunu aktif yada deaktif hale getirir.

Ayarlama

Torque kontrol, akim limiti yada akim rampa start modunun tek basina yapabileceginden daha lineer ve düzgün bir ivmelenme temin eder.

11. Kickstart [Start/Stop Formats]

Aralik: **0 – 1**
0 = Off
1 = On

FabrikaAyari: **0 (Off)**

Tanim

Kickstart fonksiyonunu aktif/deaktif hale getirir.

Ayarlama

Kickstart, bir start baslangicinda ekstra tork saglar. Bu fonksiyon özellikle ilk anda yüksek tork gerektirip daha sonra kolayca ivmelenen yükler için faydalidir.

NOT:
Kickstart motor/yük'e ilk kalkis aninda 5 saykil (100mS) süresince DOL (direkt on-line) miktarinca gerilim uygular. Bu yüzden uygulama yapmadan önce motor ve yükün bu torka dayanabileceginden emin olunuz.

12. Soft Stop Modu [Start/Stop Formatlar

Aralik: **0 – 1**
0 = Standart soft stop
1 = Pompa kontrolü/durusu

FabrikaAyari: **0 (Standart soft stop)**

Tanim

Geçerli Soft Stop Modunu belirler.

Ayarlama

Standard Soft Stop modu otomatik olarak motor yavaslamasini izler ve pek çok uygulama için optimum kontrol temin eder. Buna ek olarak, IMS2 özel pompa durus fonksiyonu bir adim ileri giderek özel bazi uygulamalarda pompa performansinda ilave yararlar saglar.Pompa uygulamalarinda soft stop yerine pompa durusu önerilir.

13. Otomatik Stop Zamanlamasi [Start/Stop Fo

Aralik: **0 – 255 birim**
1 birim = 6 dakika

FabrikaAyari: **0 (Off)**

Tanim

Otomatik durusa kadarki çalisma zamanini belirler.

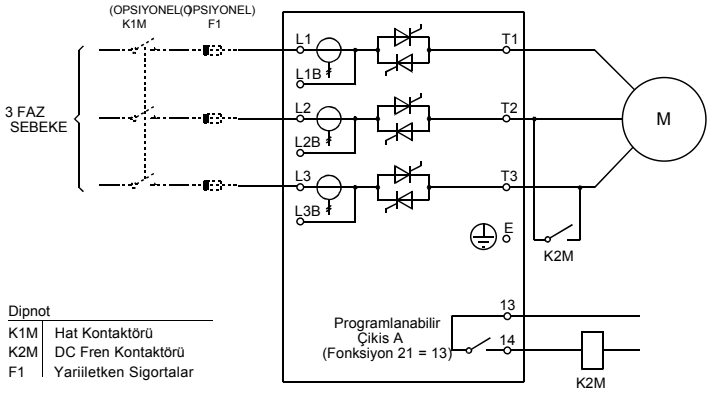
Ayarlama

Sabit bir çalisma zamanindan sonra otomatik durus isteniyorsa bu fonksiyon aktif hale getirilerek 25 saat, 30 dakikaya (6 dakika x 255 birim) kadar zaman araligi girilebilir.
0 disinda bir deger girilmesi durumunda,IMS2 tanimlanan zaman bitince motoru otomatik olarak durdurur. (detay için bölüm 7.4 isletim).

DC Frenleme

IMS2xxx-xx-xxx-F2-xx modelleri DC frenleme fonksiyonuna sahiptir. DC fren fonksiyonu,T2 & T3 çikis terminalleri arasina baglanmasi gereken ve AC1 akim sinifi,sürülen motorun FLC'sinden daha büyük olan kontaktör eklenmesini gerektirir (bkz. asagidaki elektrik tek hat semasi). DC fren fonksiyonun aktif olmasi için asagidaki fonksiyonlarin da mutlaka ayarlanmasi gerekir.

- **Fonksiyon 14 *DC Fren - Fren Zamani***
- **Fonksiyon 15 *DC Fren - Fren Torku***
- **Fonksiyon 21 *Röle Çikis A Fonksiyonalitesi***



IKAZ:
T1-T2 veya T1-T3 arasina hatali baglanan DC Fren kontaktörü IMS2 güç modüllerine zarar verir.

IKAZ:
DC fren fonksiyonu çalismiyorken kapatilan DC fren kontaktörü, IMS2 modüllerine zarar verir. DC fren kontaktörünün A röle çikisi ile kontrol edildigine ve A röle çikis fonksiyonalitesinin (Fonksiyon 21) = 13 (DC fren kontaktör kontrolü) olarak programlandigina mutlaka emin olunuz.

---

14. DC Fren - Fren Zamani [Start/Stop Forr

Aralik	FabrikaAyari
0 – 10 saniye	**0 saniye (Off)**

Tanim

DC Fren fonksiyonu için zaman araligini belirler (yalnizca F2 modellerde).

Ayarlama

Fren performansini optimize etmek için ayarlayin. 0 saniye girisi DC Fren fonksiyonunu off (deaktif) yapar.
DC fren fonksiyonunun çalismasi sirasinda IMS2 ekrani asagidaki sekilde 'br' harflerini gösterir.

br

NOT:
Soft Stop ve DC fren fonksiyonlari birlikte kullanilamaz. Fonksiyon 14 *DC Fren - Zamani* 0'dan büyük bir saniyeye ayarlandiginda, Fonksiyon 5 ve Fonksiyon 84 *Stop Rampa Zamani* otomatik olarak 0 saniye degerine dönüsmüs olur.

---

15. DC Fren - Fren Torku [Start/Stop Form

Aralik	FabrikaAyari
30 – 100% Frenleme Torku	**30%**

Tanim

Frenleme seviyesini maximum frenleme torkunun yüzdesi olarak ayarlar (F2 modellerde).

Ayarlama

Gereken sekilde ayarlayiniz.

NOT:
Çok yüksek atalet momentli yükler için daha büyük frenleme torku elde etme 'Soft Frenleme' teknigi "Bölüm 8.5 Yumusak *Frenleme" de anlatilmaktadir* .

20. Local/Remote Operasyon [Starter Fonksiyonl

Aralik: **0 – 3** — FabrikaAyari: **0 (Local/Remote buton aktif)**

0 = IMS2 <Local/Remote> : IMS2 üstündeki butonlar daima aktif
1 = IMS2 <Local/Remote> : IMS2 üstündeki butonlar motor çalisiyorken deaktif
2 = Yalnizca Lokal kontrol : IMS2 butonlari aktif, remote girisler deaktif
3 = Yalnizca Remote kontrol: IMS2 butonlari deaktif, remote girisler aktif

Tanim

Lokal cihaz butonlarini yada uzak kontrol girislerini aktif/deaktif yapmaya (ve seçmeye) yarayan fonksiyondur. Ayrica Local/Remote butonlarinin lokal yada remote kumanda seçeneklerine göre çalisma seklini belirler.

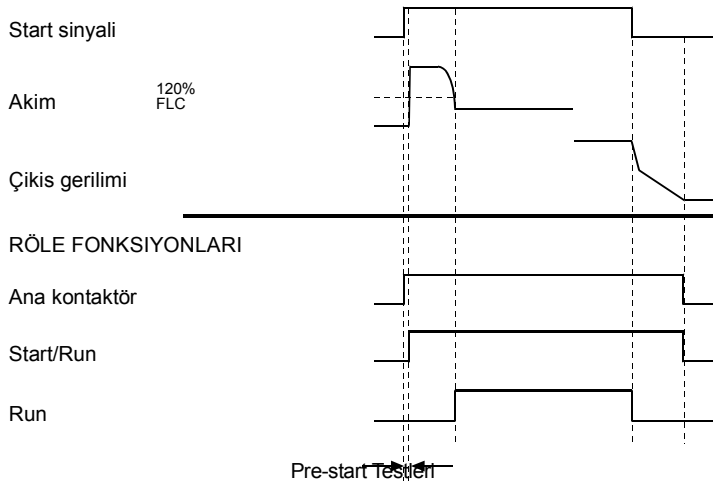
Ayarlama

Gereken sekilde ayarlayiniz.

21. Röle Çikis A Islevselligi Starter Fonksiyon]

Aralik: **0 – 14** — FabrikaAyari: **11 (Ana Kontaktör)**

0 = Açma
1 = Asiri akim açmasi
2 = Düsük akim açmasi
3 = Motor termistor açmasi
4 = Starter asiri sicaklik açmasi
5 = Faz dengesizlik açmasi
6 = Elektronik shearpin açmasi
7 = Düsük akim ikazi
8 = Yüksek akim ikazi
9 = Motor sicaklik ikazi
10 = Start/Run
11 = Ana kontaktör
12 = Yardimci açma
13 = DC Fren kontaktör kontrolü
14 = Off



Tanim

Programlanabilir A Röle Çikisinin islevini belirler.

Ayarlama

Gereken sekilde ayarlayiniz.

22. Röle Çikis B Islevselligi [Starter Fonksiyon

Aralik: **0 – 12** — FabrikaAyari: **10 (Start Run)**

Tanim

Programlanabilir B Röle Çikisinin islevini belirler.

Ayarlama

Detayli ayarlama bilgileri için Fonksiyon 21 *Röle Çikis A islevselligi* bölümüne bakiniz.

---

23. Röle Çikis C Islevselligi [Starter Fonksion]

Aralik: **0 – 12**

FabrikaAyari: **0 (Açik)**

Tanim

Programlanabilir C Röle çikisinin islevini belirler.

Ayarlama

Detayli ayarlama bilgileri için Fonksiyon 21 *Röle Çikis A islevselligi bölümüne bakiniz*.

---

24. Giris AIslevselligi [Starter Fonksiyc

Aralik: **0 – 3**

FabrikaAyari: **0 (Parametre Ayar Secimi)**

0 = Parametre Ayar Secimi
1 = Yardimci Açma (Normal olarak açik)
2 = Yardimci Açma (Normal olarak kapali)
3 = Acil Durum Modunda Çalisma

Tanim

Programlanabilir A girisinin islevini belirler.

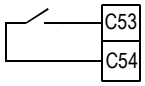
Ayarlama

Programlanabilir A girisi ile asagidaki IMS2 özellikleri aktive edilebilir:

0. Parametre Ayar Secimi

IMS2, iki ayri motor ve startlama data grubu için programlanabilir. Birincil parametre grubu Fonksiyon 1 ~ 9 kullanilarak, ikincil parametre grubu Fonksiyon 80 ~ 88 kullanilarak programlanir.

Ikincil parametre grubunun aktif olmasi için, Fonksiyon 24 Giris *A Fonksiyonalitesi* 0 olarak seçilmeli (Sekonder Parametre grubu) ve start için programlanabilir giris A kapali devre olarak tamamlanmalidir.



Programlanabilir Giris A
(Fonksiyon 24 Giris *A Fonksiyonu* = 0)

---

1. Yardimci Açma (Normal Olarak Açik)

IMS2, Fonksiyon 24 Giris A Fonksiyonu =1 olarak ayarlandiginda (yardimci açma N.O), Programlanabilir Giris *A'ya bagli uzak bir devre ile motoru açabilir*. Programlanabilir Giris A üzerinden bir kapali devre IMS2'yi açar.

Yardimci açma fonksiyonu özellikleri Fonksiyon 94 Yardimci Açma Gecikmesi ve Fonksiyon 36 Yardimci *Açma Modu ayarlari ile gerçeklestirilir*.

---

2. Yardimci Açma (Normal Olarak Kapali)

IMS2 Fonksiyon 24 Giris A Fonksiyonu=2 olarak ayarlandiginda (yardimci açma N.C), Programlanabilir Giris A'ya bagli uzak bir devre ile motoru açabilir. Programlanabilir Giris A üzerinden bir açik devre IMS2'yi açar.

Yardimci açma fonksiyonu özellikleri Fonksiyon 94 Yardimci Açma Gecikmesi ve Fonksiyon *36 Yardimci Açma Modu ayarlari ile gerçeklestirilir*.

---

3. Acil Durum Modunda Çalisma

IMS2 belirlenen koruma fonksiyonlari iptal edildiginde 'acil durum modu'nda acil durum çalismasi yapacak sekilde kumanda edilebilir (yangin aninda yangin pompa çalismasi gibi).

Acil Durum modu çalismasi, Fonksiyon 24 Giris *A Fonkiyonu=3 olarak ayarlandiginda* (Acil Durum Modu Çalismasi) mümkündür ve Programlanabilir Giris A'ya bagli bir devrenin

kapanmasi ile aktif olur. Bu IMS2'nin motoru start etmesini saglar, eger halihazirda çalismiyorsa, Fonksiyon 114 Acil Durum Modu Formatlarinda belirtilen açma sartlarini *gözardi ederek çalismaya devam eder*.

Programlanabilir Giris A'ya bagli devrenin açilmasi acil durum çalisma modunu sona erdirir ve normal IMS2 kontrol devrelerinin çalisma sekline geri doner.

Açma rölesinin 'acil mod' çalismasi sirasindaki fonksiyonu, Fonksiyon 115 Acil Mod-*Açma Röle Çalismasi tarafindan belirlenir*.

---

30. Asiri StartZamani [KorumaAyarlari]

Aralik	FabrikaAyari
0 – 255 Saniye	**20 Saniye**

Tanim

Motorun çalismasi için müsaade edilen en uzun zamani belirler.

Ayarlama

Normal,saglikli bir çalisma için gerekenden biraz daha uzun bir zamani giriniz. IMS2 start için programlanan en uzun süre limiti asildiginda açar. Dolayisiyla yük çöktügünde yada start tork ihtiyaci arttiginda bu ayarin tekrar ve dikkatli sekilde tekrar belirlenmesi gerekir. Bu fonksiyona 0 deger atamasi, bu koruma fonksiyonunu geçersiz kilar.

NOT:
Asiri Start Zamani koruma degerlerinin, IMS2 kapasitesi içinde kaldigina emin olunuz. Böylece IMS2'nin de, çöken motorun yolaçtigi asiri yük arizalarindan korunmasini temin etmis olursunuz.

---

31. Faz Sirasi [Koruma Ayarlari]

Aralik	FabrikaAyari
0 – 2	**0 (Off)**

0 = Off (ileri ve geri/ters dönüs mümkün)
1 = Sadece ileri dönüs mümkün (geri/ters dönüs yok)
2 = Sadece geri/ters dönüs mümkün (ileri dönüs yok)

Tanim

IMS2 faz sira korumasi için geçerli faz sirasini belirler. IMS2 üç faza gelen enerjiyi kontrol eder ve fazlarin dönüsü Fonksiyon 31'de belirlenen dönüs formatina uymaz ise açma yapar.

Ayarlama

Gereken sekilde ayarlayiniz.

---

32. Restart Gecikmesi [KorumaAyarlari]

Aralik	FabrikaAyari
0 – 254 birim	**1 (10 Saniye)**

1 ünite = 10 saniye

Tanim

Bir stop'un sonu ile sonraki startin baslangici arasindaki minimum zaman araligini belirler.

Ayarlama

Gereken sekilde ayarlayiniz

Restart Gecikmesi Periyodu sirasinda IMS2 LED ekraninin sagindaki LED'ler yanip sönerek motorun o anda yeniden çalistirilamayacgini ikaz eder.

NOT:
0 birim girilmesi IMS2 için minimum Restart Gecikmesi anlamina gelir ki bu periyod 1 saniyedir.

---

33. Phase Imbalance [Protection Settings]

Range: **0 – 1** Default Setting: **0 (On)**

0 = On
1 = Off

Description

Enables or disables the Phase Imbalance protection.

Adjustment

Set as required.

34. Motor Thermistor [Protection Settings]

Range: **0 – 1** Default Setting: **0 (On)**

0 = On
1 = Off

Description

Enables or disables the thermistor protection feature.

Adjustment

Set as required.

35. Starter Overtemperature [Protection Settings]

Range: **0 - 1** Default Setting: **0 (On)**

0 = On
1 = Off

Description

Enables or disables the IMS2 heatsink overtemperature protection.

Adjustment

Set as required.

CAUTION:
Defeating the IMS2 overtemperature protection may compromise starter life and should only be done in the case of emergency.

36. Auxiliary Trip Mode [Protection Settings]

Range: **0 – 12** Default Setting: **0 (Active at all times)**

0 = Active at all times
1 = Active during starting, run and stopping (disabled while stopped)
2 = Active during run only
3 = Active 30 seconds after the start command
4 = Active 60 seconds after the start command
5 = Active 90 seconds after the start command
6 = Active 120 seconds after the start command
7 = Active 180 seconds after the start command
8 = Active 240 seconds after the start command
9 = Active 300 seconds after the start command
10 = Active 600 seconds after the start command
11 = Active 900 seconds after the start command
12 = Active 1200 seconds after the start command

Description

Determines when the IMS2 monitors the auxiliary trip input.

Adjustment

Refer Function 24 *Input A Functionality* for further detail.

40. Low Current Flag [Set Points]

Range: **1 – 100% FLC** Default Setting: **50% FLC**

Description

Sets the current level (% FLC) at which the Low Current Flag operates

Adjustment

The Low Current Flag can be assigned to the programmable Relay Outputs A, B or C for indication of a motor current lower than the programmed value.

41. High Current Flag [Set Points]

Range: **50 – 550% FLC** Default Setting: **105% FLC**

Description

Sets the current level (% FLC) at which the High Current Flag operates.

Adjustment

The High Current Flag can be assigned to the programmable Relay Outputs A, B or C for indication of a motor current in excess of the programmed value.

42. Motor Temperature Flag [Set Points]

Range: **0 – 105% Motor Temperature** Default Setting: **80%**

Description

Sets the temperature (%) at which the Motor Temperature Flag operates.

Adjustment

The Motor Temperature Flag can be assigned to the programmable Relay Outputs A, B or C for indication of a motor temperature (as calculated by the Motor Thermal Model) in excess of the programmed value.

A trip condition occurs when motor temperature reaches 105%.

43. Field Calibration [Set Points]

Range: **85% – 115%** Default Setting: **100%**

Description

Adds a gain to the IMS2 current monitoring circuits. The IMS2 is factory calibrated with an accuracy of ± 5%. The Field Calibration function can be used to match the IMS2 current readout with an external current metering device.

Adjustment

Use the following formula to calculate the setting required.

$$\text{Field Calibration (Function 43)} = \frac{\text{Current shown on IMS2 display}}{\text{Current measured by external device}}$$

$$\text{e.g.} \quad 102\% = \frac{66 \text{ amps}}{65 \text{ amps}}$$

NOTE:
All current based functions are affected by this adjustment.

---

50. 4-20mA Output Functionality [Analogue Output]

Range: **0 – 1** | Default Setting: **0 (Current)**

0 = Current (% FLC)
1 = Motor Temperature (% Maximum Temperature of trip point, ie. 105%)

Description
Sets the functionality of the analogue output.

Adjustment
Set as required.

Performance of the 4-20mA signal can be set using the following functions:
Function 51 *Analogue Output Range - Max*
Function 52 *Analogue Output Range - Min*

---

51. 4-20mA Output Range - Max [Analogue Output]

Range: **0 – 255%** | Default Setting: **100 %**

Description
Determines the value represented by a 20mA signal from the analogue output.

Adjustment
Set as required.

---

52. 4-20mA Output Range - Min [Analogue Output]

Range: **0 – 255%** | Default Setting: **0 %**

Description
Determines the value represented by a 4mA signal from the analogue output.

Adjustment
Set as required.

---

60. Serial Timeout [Serial Communications]

Range: **0 – 100 Seconds** | Default Setting: **0 seconds (Off)**

Description
Sets the maximum allowable period of RS485 serial inactivity.

Adjustment
Set as required.

NOTE:
A setting of 0 seconds disables the Serial Timeout protection and enables the IMS2 to continuing operating even if the RS485 serial link becomes inactive.

---

61. Serial Baud Rate [Serial Communications]

Range: **1 – 5** | Default Setting: **4 (9600 baud)**

1 = 1200 baud
2 = 2400 baud
3 = 4800 baud
4 = 9600 baud
5 = 19200 baud

Description
Sets the baud rate for RS485 serial activity.

Adjustment
Set as required.

---

62. Serial Satellite Address [Serial Communications]

Range: **1 – 99** Default Setting: **20**

Description
Assigns the IMS2 an address for RS485 serial communication.

Adjustment
Set as required.

---

63. Serial Protocol [Serial Communications]

Range: **1 – 3** Default Setting: **1 (IMS2 ASCII)**

1 = IMS2 ASCII
2 = MODBUS RTU
3 = MODBUS ASCII

Description
Sets the protocol for RS485 serial communication.

Adjustment
Set as required.

---

64. MODBUS Parity [Serial Communications]

Range: **0 – 2** Default Setting: **0 (No parity)**

0 = No parity
1 = Odd parity
2 = Even parity

Description
Sets the parity for the MODBUS protocol (when this protocol has been selected using Function 63 *Serial Protocol)*.

Adjustment
Set as required.

---

70. Auto-Reset – Configuration [Auto-Reset]

Range: **0 – 3** Default Setting: **0 (Off)**

0 = Off
1 = Reset Group A trips
2 = Reset Group A & B trips
3 = Reset Group A, B & C trips

Description
Determines which trips will be automatically reset.

Adjustment

A setting of other than 0 causes the IMS2 to automatically reset, and after a delay if the start signal is still present, attempt to start the motor. The Auto-Reset function can be programmed to reset faults according to the table below:

Trip Group	Trip Conditions
A	Phase imbalance, Phase loss
B	Undercurrent, Electronic shearpin, Auxiliary trip
C	Overcurrent, Motor thermistor, Starter overtemperature

Operation of the Auto-Reset function is controlled according to the following function settings:

Function 70 *Auto-Reset – Configuration*
Function 71 *Auto-Reset – Number of resets*
Function 72 *Auto-Reset – Group A & B Delay*
Function 73 *Auto-Reset – Group C Delay*

CAUTION:
Operation of the Auto-Reset function will reset a trip state and if the start signal is still present, allow the motor to restart. Ensure that personal safety is not endangered by such operation and that all relevant safety measures and/or regulations are complied with before utilising this function.

71. Auto-Reset – Number of Resets [Auto-Reset]

Range: **1 – 5**
Default Setting: **1**

Description

Sets maximum number of reset attempts for the Auto-Reset function.

Adjustment

The Auto-Reset counter increases by one after each trip, up to the maximum number of resets set in Function 71 *Auto-Reset – Number of Resets*. The fault is then latched and a manual reset is required.

The Auto-Reset counter decreases by one, to a minimum of zero, after each successful start/stop cycle.

Refer Function 70 *Auto-Reset – Configuration* for further detail.

72. Auto-Reset – Group A & B Delay [Auto-Reset]

Range: **5 – 999 seconds**
Default Setting: **5 seconds**

Description

Sets the delay for resetting of Group A & B trips.

Adjustment

Refer Function 70 *Auto-Reset – Configuration* for further detail.

73. Auto-Reset – Group C Delay [Auto-Reset]

Range: **5 – 60 minutes**
Default Setting: **5 minutes**

Description

Sets the delay for resetting of Group C trips.

Adjustment

Refer Function 70 *Auto-Reset – Configuration* for further detail.

IMS2 soft starters can be programmed with two separate sets of motor data. The primary motor settings are adjusted using Functions 1 ~ 9. The secondary motor settings are adjusted using Functions 80 ~ 88. Refer to Function 24 *Input A Functionality* for detail on enabling the secondary parameter set.

80. Motor Full Load Current [Secondary Motor Settings]

Range: **Model Dependent (amps)**
Default Setting: **Model Dependent (amps)**

Description
Sets the IMS2 for the connected motor's Full Load Current.

Adjustment
Refer Function 1 for further detail.

81. Current Limit [Secondary Motor Settings]

Range: **100 – 550 % FLC**
Default Setting: **350% FLC**

Description
Sets the Current Limit for the Constant Current start mode.

Adjustment
Refer Function 2 for further detail.

82. Initial Start Current [Secondary Motor Settings]

Range: **100 – 550 % FLC**
Default Setting: **350% FLC**

Description
Sets the Initial Start Current level for the Current Ramp start mode.

Adjustment
Refer Function 3 for further detail.

83. Start Ramp Time [Secondary Motor Settings]

Range: **1 – 30 Seconds**
Default Setting: **1 Second**

Description
Sets the ramp time for the Current Ramp start mode.

Adjustment
Refer Function 4 for further detail.

84. Stop Ramp Time [Secondary Motor Settings]

Range: **0 – 100 Seconds**
Default Setting: **0 Second (Off)**

Description
Sets the soft stop ramp time for soft stopping of the motor.

Adjustment
Refer Function 5 for further detail.

85. Motor Start Time Constant [Secondary Motor Settings]

Range: **0 – 120 Seconds**
Default Setting: **10 Seconds**

NOTE:
A setting of 0 seconds disables the IMS2 motor thermal model. Use this setting only if another form of motor protection is used.

Description
Sets the motor thermal capacity used by the IMS2 motor thermal model.

Adjustment
Refer Function 6 for further detail.

86. Phase Imbalance Sensitivity [Secondary Motor Settings]

Range: **1 – 10**
Default Setting: **5 (Normal sensitivity)**

1 = Highest sensitivity
|
5 = Normal sensitivity
|
10 = Lowest sensitivity

Description
Sets the sensitivity of the phase imbalance protection.

Adjustment
Refer Function 7 for further detail.

87. Undercurrent Protection [Secondary Motor Settings]

Range: **0% – 100% FLC**
Default Setting: **20% FLC**

Description
Sets the trip point for the IMS2 Undercurrent Protection as a percentage of motor full load current.

Adjustment
Refer Function 8 for further detail.

88. Electronic Shearpin Protection [Secondary Motor Settings]

Range: **80% – 550% FLC**
Default Setting: **400% FLC**

Description
Sets the trip point for the IMS2 Electronic Shearpin Protection as a percentage of motor full load current.

Adjustment
Refer Function 9 for further detail.

90. Phase Imbalance Trip Delay [Protection Delays]

Range: **3 – 254 Seconds**
Default Setting: **3 Seconds**

Description
Sets the delay period between detection of a phase imbalance greater than allowed by the setting made in Functions 7 & 86 *Phase Imbalance Sensitivity* and a trip condition.

Adjustment
Set as required.

---

91. Undercurrent Trip Delay [Protection Delays]

Range: **0 – 60 Seconds** Default Setting: **5 Seconds**

Description
Sets the delay period between detection of a current lower than set in Functions 8 & 87 *Undercurrent Protection* and a trip condition.

Adjustment
Set as required.

---

92. Electronic Shearpin Delay [Protection Delays]

Range: **0 – 60 seconds** Default Setting: **0 Seconds**

Description
Sets a delay period between application of full voltage to the motor and the Electronic Shearpin protection being enabled.

Adjustment
Set as required.

---

93. Out of Frequency Trip Delay [Protection Delays]

Range: **0 – 60 seconds** Default Setting: **0 Seconds**

Description
Sets the delay period between detection of a low supply frequency while the motor is running (<48Hz for 50Hz supplies, <58Hz for 60Hz supplies) and a trip condition.

Adjustment
Set to allow continued motor operation during extreme but temporary under frequency conditions that endanger motor life.

NOTE:
If the supply frequency drops below 45Hz (50Hz supplies) or 55Hz (60Hz supplies) the IMS2 will trip immediately irrespective of the delay setting.

---

94. Auxiliary Trip Delay [Protection Delays]

Range: **0 – 240 Seconds** Default Setting: **0 Seconds**

Description
Sets a delay period between activation of the auxiliary trip input and a trip condition.

Adjustment
Refer Function 24 *Input A Functionality* for further detail.

---

100. Model Number [Read Only Data]

Range: **1 – 22** Default Setting: **Model Dependent**

Description
A diagnostic parameter used to identify the power assembly type.

---

101. Start Counter (1000's) [Read Only Data]

Range: **1(,000) – 999(,000)** Default Setting: **n/a**

Description
Displays the number of successful starts.

Must be read in conjunction with Function 102 for total start count.

---

102. Start Counter (1's) [Read Only Data]

Range: **0 – 999** Default Setting: **n/a**

Description
Displays the number of successful starts.

Must be read in conjunction with Function 101 for total start count. (Note that it is normal for the IMS2 to have recorded a limited number of starts during the factory testing process).

---

103. Trip Log [Read Only Data]

Range: **1-x – 8-x** Default Setting: **n/a**

Description
Displays the IMS2 Trip Log.

Adjustment
Use the **<UP>** and **<DOWN>** keys to scroll through the trip log.

Refer to Section 9 *Trouble Shooting Procedure* for a description of the trip log and fault conditions.

---

110. Access Code [Restricted Functions]

Range: **0 – 999** Default Setting: **0**

Description
Entering the correct access code does two things:

1. Temporarily changes the function lock to Read/Write irrespective of the state specified by Function 112 *Function Lock*. This allows function settings to be adjusted during the current programming session. On exit of the current programming session function settings are again protected according to Function 112 *Function Lock.*
2. Provides access to Functions 111 - 117.

Adjustment
Enter access code. The default access code is 0. Contact your supplier if the access code is lost or forgotten.

---

111. Update Access Code [Restricted Functions]

Range: **0 – 999** Default Setting: **0**

Description
Changes the current access code.

Adjustment

Set as required, remembering to make note of the new access code.

112. Function Lock [Restricted Functions]

Range: **0 – 1**

Default Setting: **0 (Read / Write)**

0 = Read/Write
1 = Read Only

Description

Allows protection of all function settings. Note that when this function has been changed from 0 (Read/Write) to 1 (Read Only) the new setting takes effect only when program mode is exited.

Adjustment

Set as required.

113. Restore Function Settings [Restricted Functions]

Range: **50, 60, 70**

Default Setting: **0**

50 = Load default settings
60 = Archive current function settings
70 = Load archived function settings

Description

Allows function adjustments be returned to the factory defaults. Additionally users can archive their own function settings, for example the commissioning settings, and then restore these at a later date.

Adjustment

Load or archive function settings as required.

114. Emergency Mode – Format [Restricted Functions]

Range: **0 – 4**

Default Setting: **0 (Off)**

0 = Off
1 = Trip Group A
2 = Trip Group A & B
3 = Trip Group A, B & C
4 = All trips

Description

Sets which trip conditions are ignored during Emergency Mode operation. Refer to Function 24 *Input A Functionality* for a description of Emergency Mode operation.

Adjustment

Sets as required.

Trip Group	Trip Conditions
A	Phase imbalance, Phase loss
B	Undercurrent, Electronic Shearpin, Auxiliary Trip
C	Overcurrent, Motor thermistor, Starter overtemperature

115. Emergency Mode – Trip Relay Operation [Restricted Functions]

Range: **0 – 1**

Default Setting: **0 (Trips not indicated)**

0 = Trips not indicated

1 = Trips indicated

Description

Sets whether or not output relays assigned to the trip function (Refer Functions 21, 22 & 23) change state in the event of a detected fault condition when the IMS2 is operating in Emergency Mode.

Refer to Function 24 *Input A Functionality* for a description of Emergency Mode operation.

Adjustment

Set as required.

---

116. Thermal Model – Override [Restricted Functions]

Range	Default Setting
0 – 150%	**n/a**

Description

Allows the motor thermal model to be manually adjusted.

CAUTION:
Adjustment of the motor thermal model may compromise motor life and should only be done in the case of emergency.

Adjustment

In emergency situations the motor thermal model can be manually decreased to allow a restart of the motor. Adjust as required.

---

117. Thermal Model – Override Count [Restricted Functions]

Range	Default Setting
0 – 255	**n/a**

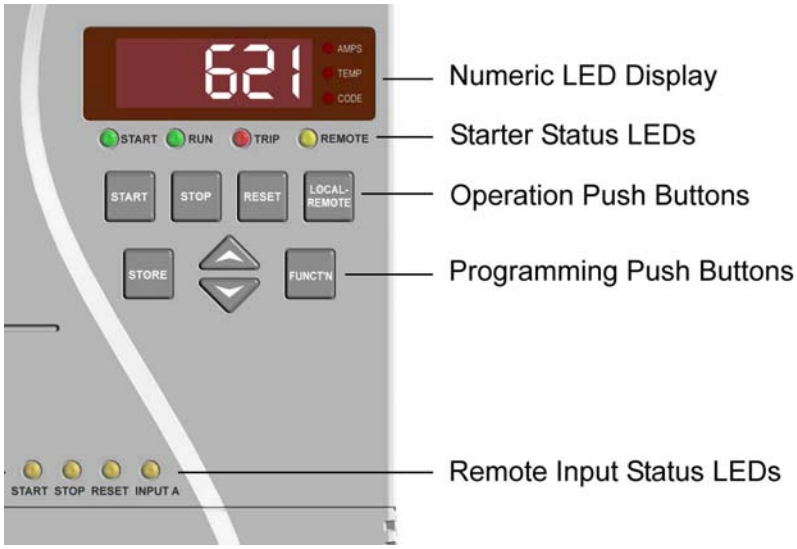
Description

Displays the number of times the motor thermal model has been manually adjusted.

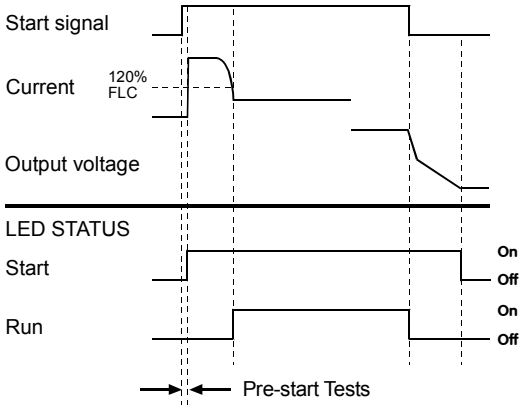
7.4 Operation

Once installed, wired and programmed according to the instructions earlier in this manual, the IMS2 can be operated.

Local control panel.



1. *Numeric LED Display:* The information being displayed is indicated by the LEDs to the right of the display. During operation either motor current (amps) or the calculated motor temperature (%) can be displayed. Use the **<UP>** and **<DOWN>** keys to select what information is displayed. In the event of a trip state the relevant trip code will be shown.
   If motor current exceeds the maximum current able to be shown on the numeric display, the display will show dashes. ---
2. *Starter Status LEDs:*
   Start: Voltage is being applied to the motor terminals.
   Run: Full voltage is being applied to the motor terminals.
   Trip: The IMS2 has tripped.
   Remote: The IMS2 is in remote control mode.



3. *Operation Push Buttons:* These push buttons can be used to control IMS2 operation when in local control mode. The **<LOCAL/REMOTE>** push button can be used to switch between local and remote control.

NOTE:
When control power is applied to the IMS2 it may be in either local or remote control mode according to the mode it was in when control power was removed. The factory default is local control.

NOTE:
Function 20 *Local/Remote Operation* can be used to limit operation to either local or remote mode operation. If the **<LOCAL/REMOTE>** push button is used in an attempt to switch to a prohibited mode the numeric display will show 'OFF'.

NOTE:
Simultaneously pressing the **<STOP>** and **<RESET>** push buttons causes the IMS2 to immediately remove voltage from the motor, resulting in a coast to stop. Any soft stop or DC brake settings are ignored.

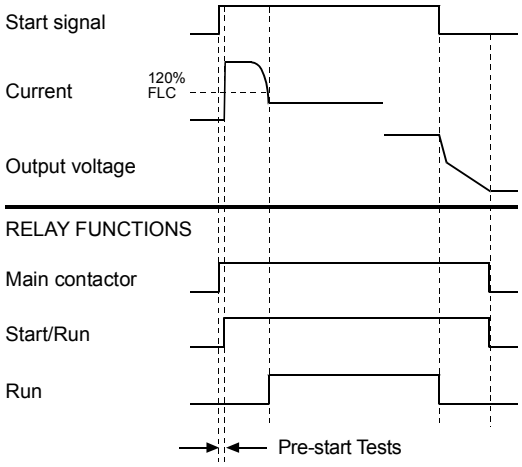
4. *Programming Buttons:* Refer to Section 7.1.
5. *Remote Input Status LEDs:* These LEDs indicate the state of the circuits across the IMS2 remote control inputs.

NOTE:
All LEDs and the Numeric Display are illuminated for approximately 1 second to test their operation when control power is first applied.

Remote control.
IMS2 operation can be controlled via the remote control inputs when the soft starter is in remote mode. Use the **<LOCAL/REMOTE>** push button to switch between local and remote modes. Refer to Section 6.3 *Control Wiring* for further detail.

Restart delay.
Function 32 *Restart Delay* sets the delay period between the end of a stop and the beginning of the next start. During the restart delay period the LEDs to the right of the numeric display will flash indicating that a restart cannot yet be attempted.

Pre-start tests.
Before applying voltage to the motor when a start is initiated, the IMS2 first performs a series of tests to check the motor connection and supply conditions.



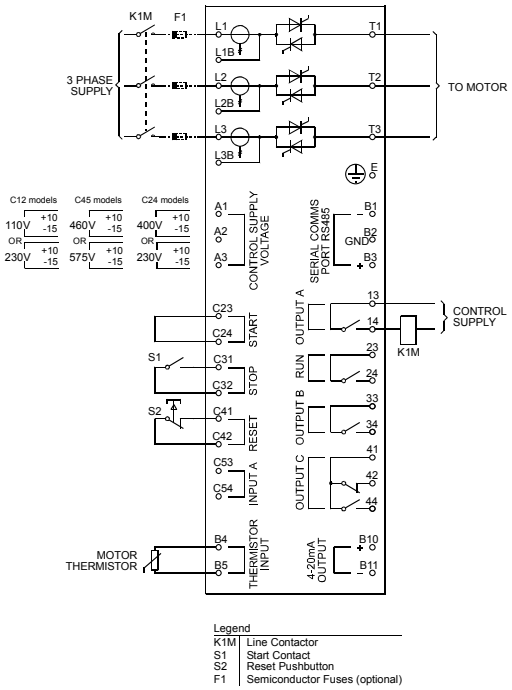
Secondary motor settings.
IMS2 starters can be programmed with two motor parameter sets. The primary motor parameters are set using Functions 1 ~ 9. The secondary motor parameters are set using Functions 80 ~ 88.
Programmable Input A can be used to select between the two parameter sets. Refer to Function 24 *Input A Functionality* for further detail.

Auto-Stop 'short-cut'.
A 'short-cut' allows setting of the Auto-Stop function without the need to follow the full programming procedure.
1. Simultaneously press the **<STOP>** and **<FUNCTION>** keys.
   This enters the programming mode & displays the value of Function 13 *Auto-Stop – Run Time.*
2. Use the **<UP>** and **<DOWN>** keys to set the run time.
3. Simultaneously press the **<STOP>** and **<FUNCTION>** keys to store the programmed run time and exit programming mode.

When a start is next initiated the IMS2 will run for the prescribed time. While running under the Auto-Stop condition the Start and Run LEDs will flash together.

Section 8 Application Examples

8.1 Installation With Line Contactor



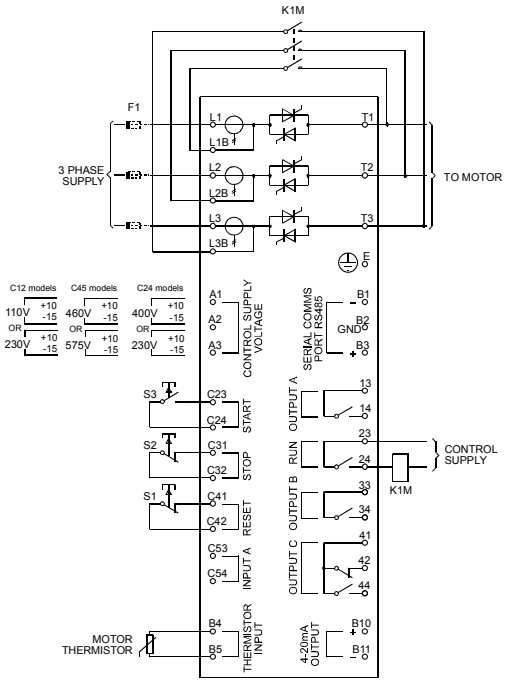
Legend

K1M	Line Contactor
S1	Start Contact
S2	Reset Pushbutton
F1	Semiconductor Fuses (optional)

Description:
The IMS2 is installed with a line contactor (AC3 rated). The line contactor is controlled by the IMS2 Main Contactor output, which by default is assigned to RELAY OUTPUT A (terminals 13, 14). The control supply must be sourced from before the contactor.

Function Settings:
- Function 21 *Relay Output A Functionality* = 11 (assigns the Main Contactor function to Relay Output A).

8.2 Installation With Bypass Contactor



Legend

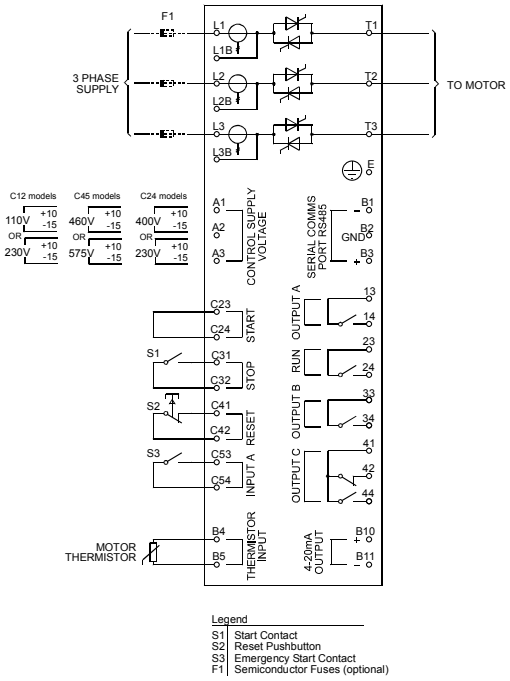
K1M	Bypass Contactor
S1	Reset Pushbutton
S2	Stop Pushbutton
S3	Start Pushbutton
F1	Semiconductor Fuses (optional)

Description:
The IMS2 is installed with a bypass contactor (AC1 rated). The bypass contactor is controlled by the IMS2 RUN OUTPUT (terminals 23, 24).

Function Settings:
- No special settings required.

APPLICATION EXAMPLES

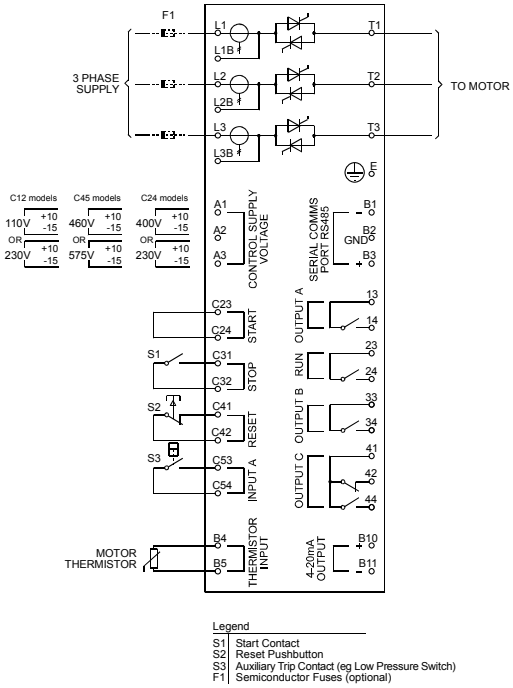
8.3 Emergency Mode Operation



Description:
In normal operation the IMS2 is controlled via a remote two wire signal.
For emergency operation, an additional remote two wire circuit has been connected to INPUT A. Closing this circuit causes the IMS2 to run the motor and ignore any user defined trip conditions that may be detected during the emergency run period.

Function Settings:
- Function 24 *Input A Functionality* = 3 (assigns Input A to the *Emergency Mode Operation* function).
- Function 114 *Emergency Mode Format* = as desired (sets which trip types are ignored during emergency mode operation).
- Function 115 *Emergency Mode - Trip Relay Operation* = as desired (determines if the trip relay operates when a fault is detected during emergency mode operation).

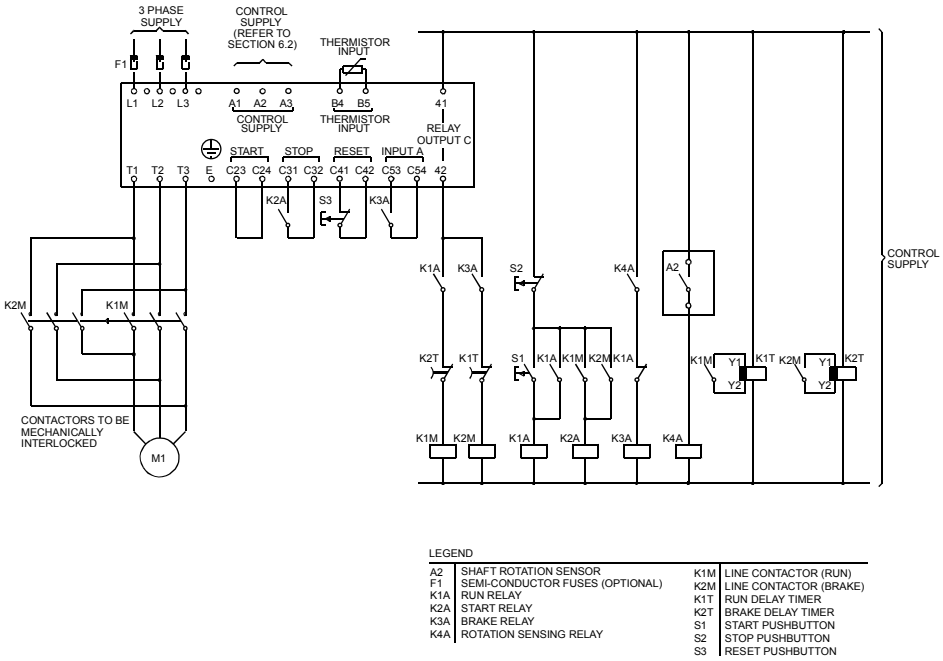
8.4 Auxiliary Trip Circuit



Description:
The IMS2 is controlled via a simple remote two wire signal.
An external trip circuit (in this case a low pressure alarm switch for a pumping system) has been connected to INPUT A. Operation of the external trip circuit causes the IMS2 to trip the motor, close the trip output, display the relevant trip code and record the event in the trip log.

Function Settings:
- Function 24 *Input A Functionality* = 1 (assigns Input A to the Auxiliary Trip (N.O.) function).
- Function 36 *Auxiliary Trip Mode* = 6 (limits operation of the Auxiliary Trip function to 120 seconds after the start command, so that pressure has time to build up in the piping before the low pressure alarm becomes active).
- Function 94 *Auxiliary Trip Delay* = as desired (can be used to provide a further delay for pressure to build up before the low pressure alarm becomes active).

8.5 Soft Braking



LEGEND

A2	SHAFT ROTATION SENSOR	K1M	LINE CONTACTOR (RUN)
F1	SEMI-CONDUCTOR FUSES (OPTIONAL)	K2M	LINE CONTACTOR (BRAKE)
K1A	RUN RELAY	K1T	RUN DELAY TIMER
K2A	START RELAY	K2T	BRAKE DELAY TIMER
K3A	BRAKE RELAY	S1	START PUSHBUTTON
K4A	ROTATION SENSING RELAY	S2	STOP PUSHBUTTON
		S3	RESET PUSHBUTTON

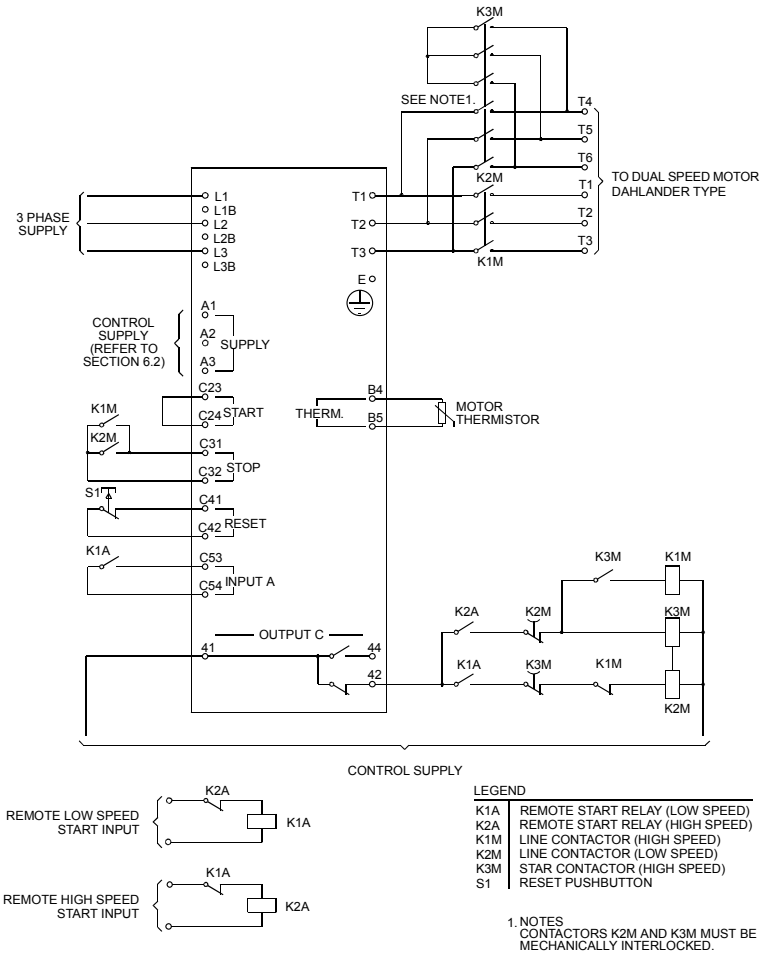
Description:
For high inertia loads that require more braking torque than is available from the DC Brake feature, the IMS2 can be configured for 'Soft Braking'.
In this application the IMS2 is employed with Forward Run and Braking contactors. On receipt of a start signal (pushbutton S1) the IMS2 closes the Forward Run contactor (K1M) and controls the motor according to the programmed Primary Motor Settings.
On receipt of a stop signal (pushbutton S2) the IMS2 opens the Forward Run contactor (K1M) and closes the Braking contactor (K2M) after a delay of approximately 2-3 seconds (K1T). K3A is also closed to activate the Secondary Motor Settings which should be user programmed for the desired stopping performance characteristics.
When motor speed approaches zero the shaft rotation sensor (A2) stops the soft starter and opens the Braking contactor (K2M).

Function Settings:
- Function 23 *Relay Output C Functionality* = 0 (assigns the Trip function to Relay Output C).
- Function 24 *Input A Functionality* = 0 (assigns Input A to the Parameter Set Selection function).
- Functions 1 ~ 9 (sets starting performance characteristics).
- Functions 80 ~ 88 (sets braking performance characteristics).

NOTE:
If the IMS2 soft starter trips on a code 5 Supply Frequency Trip when the braking contactor K2M opens, increase the setting of Function 93 *Out of Frequency Trip Delay.*

APPLICATION EXAMPLES

8.6 Two Speed Motor



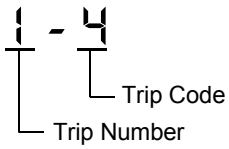
Description:
The IMS2 can be configured for control of dual speed Dahlander type motors.
In this application the IMS2 is employed with a High Speed contactor (K1M), Low Speed contactor (K2M) and a Star contactor (K3M).
On receipt of a High Speed start signal the High Speed contactor (K1M) and Star contactor (K3M) are closed. The IMS2 then controls the motor according to the Primary Motor Parameter set (Function Numbers 1 ~ 9).
On receipt of a Low Speed start signal the Low Speed contactor (K2M) is closed. The relay contact across Input A is also closed causing the IMS2 to control the motor according to the Secondary Parameter set (Function Numbers 80 ~ 88).

Function Settings:
- Function 23 *Relay Output C Functionality* = 0 (assigns the Trip function to Relay Output C).
- Function 24 *Input A Functionality* = 0 (assigns Input A to the Parameter Set Selection function).

Section 9 Trouble Shooting

9.1 Trip Codes

When the IMS2 enters the trip state the cause of the trip is indicated on the LED display panel.



Code	Description
0	**Shorted SCR** The IMS2 has detected a shorted SCR(s). 1. Determine the affected phase using the 3 phase indicator LEDs located on the left hand side of the IMS2 cover. Damaged SCRs are indicated by an extinguished phase indicator LED (all phase indicator LEDs should be illuminated when input voltage is present but the motor is not running). SCR damage can be verified using the Power Circuit Test described in Section 9.4 *Tests & Measurements*. 2. Replace the damaged SCR. 3. Reset the trip condition by removing and reapplying control voltage to the IMS2.
1	**Excess start time trip** Motor start time has exceeded the limit set in Function 30 *Excess Start Time*. 1. Ensure the load is not jammed. 2. Ensure the starting load has not increased. 4. Verify that the start current is as expected using the Start Performance Test described in Section 9.4 *Tests & Measurements*.
2	**Motor thermal model trip** The motor has been overloaded and the motor's thermal limit, as calculated by the IMS2 motor thermal model, has been reached. 1. Remove the cause of the overload and let the motor cool before restarting. **NOTE:** If the motor needs to be immediately restarted in an emergency situation and motor life can be risked, the IMS2 Motor Thermal Model can be lowered to allow an immediate restart using Function 116 *Thermal Model - Override*.
3	**Motor thermistor trip** The motor thermistors have indicated an overtemperature situation. 1. Identify and correct the cause of the motor overheating. 2. If no thermistors are connected to the IMS2, ensure there is a closed circuit across the motor thermistor input (terminals B4 & B5) or that the Motor Thermistor Protection is turned Off by setting Function 34 *Motor Thermistor* = 1.
4	**Phase imbalance trip** An imbalance in the phase currents has exceeded the limits set in Function 7 *Phase Imbalance Sensitivity*. 1. Monitor the supply voltage. 2. Check the motor circuit.

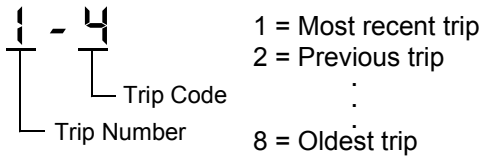
TROUBLE SHOOTING

Code	Description
5	**Supply frequency trip** Supply frequency has varied outside the IMS2's specified range. 1. Correct the cause of the frequency variations. 2. Check the three phase supply to the IMS2. Loss of all three phases is seen by the IMS2 as a 0Hz situation and may be the cause of a supply frequency trip. 3. If the frequency variation causing the trip is only temporary and occurs while the motor is running Function 93 *Out of Frequency Trip Delay* can be used to 'ride through' the out of frequency situation. Note that running a motor at less than its designed frequency increases motor heating and should only be allowed for short periods.
6	**Phase sequence trip** The IMS2 has detected a phase sequence that has been prohibited by the setting made in Function 31 *Phase Sequence*. 1. Change the incoming phase sequence.
7	**Electronic shearpin trip** The IMS2 has measured a current equal to the limit set in Function 9 *Electronic Shearpin Protection*. 1. Identify and correct the cause of the instantaneous overcurrent event.
8	**Power circuit fault** The IMS2 has detected a fault in the power circuit. 1. Ensure that the motor is correctly connected to the IMS2 and verify the circuit. 2. Check that voltage is correctly applied to all three IMS2 input terminals (L1, L2 & L3). 3. Test the IMS2 power circuit using the Power Circuit Test described in Section 9.4 *Tests & Measurements.*
9	**Undercurrent trip** The IMS2 has measured a run current lower than the limit set in Function 8 *Undercurrent Protection*. 1. Identify and correct the cause of the undercurrent event.
u	**Auxiliary trip** Input A has been assigned to the Auxiliary Trip function (refer Function 24 *Input A Functionality*) and the IMS2 has detected an invalid circuit across programmable Input A. 1. Determine and correct the cause of the invalid circuit on Input A.
F	**Heatsink overtemperature trip** The IMS2 heatsink temperature sensor has indicated an excess heatsink temperature. 1. Verify that the IMS2 has sufficient ventilation. 2. Verify that cooling air is able to freely circulate through the IMS2. 3. Verify that the IMS2 cooling fans (if fitted) are working.
P	**Invalid motor connection** The IMS2 cannot detect a valid 6 Wire motor circuit connection. 1. Ensure the motor is connected to the IMS2 in a valid configuration. Refer to Section 5 *Power Circuits* for further detail.
C	**RS485 communication fault** The RS485 serial link connected to the IMS2 has been inactive for a period of time greater than set in Function 60 *Serial Timeout*. 1. Restore the RS485 serial link.

Code	Description
E	**EEPROM read/write failure** The IMS2 has failed to read or write to the internal EEPROM. 1. Reset the IMS2. If the problem persists contact your supplier.
L	**Out of range FLC** The IMS2 has detected that the motor is connected in 3 Wire configuration and that Function 1 *Motor FLC* or Function 80 *Motor FLC* (secondary motor settings) has been set in excess of the IMS2's maximum capability for this connection format. 1. Reduce the motor FLC setting and then reset the IMS2. Note that the IMS2 cannot be reset until the FLC setting has been corrected. 2. Alternatively, remove control voltage from the IMS2 and reconnect the motor in 6 Wire configuration.
Y	**Incorrect main control module** The IMS2 is fitted with an incompatible main control module. 1. Fit a suitable main control module.
U	**CPU error** 1. Reset the IMS2. If the problem persists contact your supplier.

9.2 Trip Log

The IMS2 includes a Trip Log that records the last eight trip events. Each trip is numbered. Trip number 1 is the most recent trip with trip number 8 being the oldest.



The trip log can be viewed by selecting Function 103 *Trip Log* and using the **<UP>** and **<DOWN>** keys to scroll through the trip log.

NOTE:
The IMS2 records trips in the trip log immediately after they are detected, this requires control voltage to be present after the trip. Trips caused by or involving a loss of control voltage may not be recorded.

A 'marker' can be inserted into the trip log to identify trips that have occurred after placement of the 'marker'. To insert a 'marker' enter the programming mode and move to Function 103 *Trip Log*. Then simultaneously depress the **<UP>** and **<DOWN>** and **<STORE>** keys. The marker is added as the most recent trip and is displayed as three horizontal lines as shown below.

NOTE:
Trip markers must be separated by at least one trip and cannot be placed consecutively.

9.3 General Faults

Symptom	Cause
IMS2 will not operate	**Local push buttons not active.** The IMS2 may be in remote control mode (refer to Function 20 *Local/Remote Operation*). **Remote control inputs not active.** The IMS2 may be in local control mode (refer to Function 20 *Local/Remote Operation*). **Faulty start signal.** Verify any circuits connected to the IMS2 remote control inputs. The state of the remote circuits is indicated by the IMS2 remote control input LEDs. The LEDs are illuminated when there is a closed circuit. For there to be a successful start there must be a closed circuit across the start, stop and reset circuits. **No, or incorrect control voltage.** Ensure the correct control voltage is applied to the inputs A1, A2, A3.
IMS2 will not operate	**Restart delay active.** The IMS2 cannot be started during the restart delay period. The period of the restart delay is set using Function 32 *Restart Delay*. **Auto-reset function active.** If there has been a trip and the auto-reset function is active the fault must be manually reset before a manual restart can be attempted (refer to Functions 70, 71, 72 & 73 *Auto-Reset*). **IMS2 in programming mode.** The IMS2 will not run while in programming mode.
Uncontrolled start	**Power factor correction capacitors connected to the IMS2 output.** Remove any power factor correction from the output of the soft starter. Connection of power factor correction capacitors to the output of a soft starter can result in damage to the SCRs so they should be checked by using the Power Circuit Test described in Section 9.4 *Tests & Measurements*. **Damaged SCRS.** Verify soft starter operation using the Power Circuit Test described in Section 9.4 *Tests & Measurements.* **Damaged firing circuit.** Verify the IMS2 SCR firing circuit using the Power Circuit Test described in Section 9.4 *Tests & Measurements.*
IMS2 display shows an 'h'	**The START button on the local control panel is stuck**. Release the button to restore normal operation.
The motor will not accelerate to full speed	**Start current too low**. Check the load is not jammed. Increase start current using Function 2 *Current Limit*.
Erratic motor operation and tripping	**SCRs not latching.** SCRs require a minimum current flow to 'latch' on. In situations where large soft starters are controlling very small motors the current drawn may be insufficient to latch on the SCRs. Reduce soft starter size or increase motor size.
Soft stop ends before the programmed ramp time	**Motor will not stall.** The IMS2 has significantly reduced the voltage applied to the motor without detecting a reduction in motor speed. This indicates that with present motor loading further control of the voltage will be ineffectual, hence the Soft Stop function has halted.
IMS2 will not enter the programming mode	**The IMS2 is running.** The IMS2 must be stopped before programming mode can be accessed. **No, or incorrect, control voltage.** Ensure the correct control voltage is applied to the inputs A1, A2, A3.

Symptom	Cause
Function settings cannot be made or are not recorded	**Incorrect programming procedure**. Function settings must be stored using the **<STORE>** button. Refer to Section 7.1 *Programming Procedure* for further detail. **Function settings are locked**. Ensure that Function 112 *Function Lock* is set for Read/Write.

9.4 Tests & Measurements

Test	Procedure
Control input test	This test verifies circuits connected to the IMS2 remote control inputs (Start, Stop, Reset & Input A). 1. Measure the voltage across each input. With the remote circuit closed there should be 0VDC measured. If 24VDC is measured the switch/control is incorrectly connected or faulty.
Run performance test	This test verifies correct operation of the IMS2 during run. 1. Measure the voltage drop across each phase of the IMS2 (L1–T1, L2–T2, L3–T3). The voltage drop will be less than approximately 2VAC when the IMS2 is operating correctly.
Power circuit test	This test verifies the IMS2 power circuit including the SCR, firing loom and control module. 1. Remove the incoming supply from the IMS2 (L1, L2, L3 and control supply). 2. Remove the motor cables from the output terminals of the IMS2 (T1, T2 & T3). 3. Use a 500VDC insulation tester to measure the resistance between the input and output of each phase of the IMS2 (L1-T1, L2-T2, L3-T3). Note that low voltage ohm meters or multi-meters are not adequate for this measurement. 4. The measured resistance should be close to 33kΩ and approximately equal on all three phases. 5. If a resistance of less than about 10kΩ is measured across the SCR, the SCR should be replaced. 6. If a resistance greater than about 60kΩ is measured across the SCR there could be a fault with the IMS2 control module or firing loom.
Start performance test	This test verifies correct operation of the IMS2 during start. 1. Determine the expected start current by multiplying the settings made in Function 1 *Motor Full Load Current* and Function 2 *Current Limit*. 2. Start the motor and measure the actual start current. 3. If the expected start current and the actual start current are the same, the IMS2 is performing correctly.

Section 10 Appendix

10.1 Soft Start Technology

Soft starter products fall into four distinct categories and can be characterised as follows:

1. Start Torque Controllers

Start Torque Controllers control just one phase of three phase motors. Controlling just one phase provides a level of control over motor starting torque, but does little to reduce the starting current. Current equal to almost DOL levels flows in the motor winding not controlled by the starter. This level of current is maintained for a longer period than that experienced during a DOL start, thereby potentially causing excessive motor heating.

Start torque controllers should not be used in applications requiring a reduction in start current, having a very high starting frequency, or for starting high inertia loads.

2. Open loop voltage controllers

Open loop voltage controllers follow a user defined time referenced voltage pattern and receive no feedback from the motor. They offer the electrical and mechanical benefits normally associated with soft start and may control either two or all three phases to the motor.

Start performance is controlled by the user through adjustments such as initial voltage and start ramp time. Many open loop voltage controllers also offer a current limiting adjustment however this functionality is generally achieved by maintaining a constant reduced voltage throughout the starting period. Control over motor deceleration is also often provided through the soft stop feature which ramps down voltage during a stop thus extending motor deceleration time.

Two-phase open loop controllers provide a reduced starting current in all three phases, however the current is not balanced. Although an improvement on the single controlled phase controllers they generally provide limited start time adjustability and should be used only on light load applications to avoid motor over-heating.

3. Closed loop voltage controllers

Closed loop voltage controllers are an enhancement of the open loop systems described above. They receive feedback of the motor current and use this to halt the voltage ramp when the user set start current limit is reached. The current feedback is also used to provide basic protection functions such as motor overload, phase imbalance, electronic shearpin etc.

Closed loop voltage controllers can be used as complete motor starting systems.

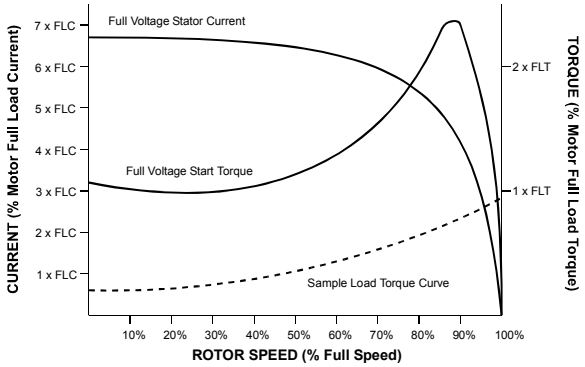
4. Closed loop current controllers

Closed loop current controllers are the most advanced form of soft start technology. Closed loop current controllers use current rather than voltage as the primary reference. This direct control of the current provides more precise control of motor starting performance as well as simplifying adjustment and programming of the soft starter. Many of the parameter settings required by the closed loop voltage system are made automatically by current based systems.

The IMS2 soft starters covered in this manual are closed loop current controllers.

10.2 Reduced Voltage Starting

When started under full voltage conditions an AC induction motor will initially draw Locked Rotor Current (LRC) and produce Locked Rotor Torque (LRT). During motor acceleration the current will fall, while torque will first increase to break down torque and then fall to full speed levels. Motor design determines the magnitude and shape of both the current and torque curves.



Starting performance of motors with similar full speed characteristics can vary dramatically. Locked rotor currents can range from 500% to in excess of 900% of motor FLC. Similarly, locked rotor torque figures can range from as low as 70% to as much as 230% of motor Full Load Torque (FLT). These performance characteristics are determined by the design of the motor and set the limits of what can be achieved by the application of a reduced voltage starter.

For applications in which the minimisation of start current and maximisation of starting torque is essential, it is important to ensure that a motor with low Locked Rotor Current and high Locked Rotor Torque is used.

Under reduced voltage starting conditions a motor's torque output is reduced by the square of the current reduction as shown in the formula below.

$$T_{ST} = LRT \times \left(\frac{I_{ST}}{LRC} \right)^2$$

T_{ST} = Start Torque
I_{ST} = Start Current
LRC = Motor Locked Rotor Current
LRT = Motor Locked Rotor Torque

When applying a reduced voltage starter, the start current can be reduced only to the point where the resulting start torque still exceeds the torque required by the load. If the torque output from the motor falls below the torque required by the load at any point during motor starting acceleration will cease and the motor/load will not reach full speed.

10.3 Star Delta Starters

Although the star/delta starter is the most common form of reduced voltage starting its full benefits can only be realised in very lightly loaded applications.

During start, the motor is initially connected in star and the current and torque are reduced to one third that available under direct on line starting conditions. After a user-defined period of time, the motor is disconnected from supply and then reconnected in delta.

For a star/delta starter to be effective, the motor must be capable of producing sufficient torque to accelerate the load to full speed whilst connected in star. A transition from star to delta at much less than full speed will result in a current and torque step to levels approximating that under DOL starting.

In addition to the step in current and torque, severe transients also occur during the transition from star to delta. The magnitude of these transients is dependent upon the phase angle and level of voltage generated by the motor during the transition from star to delta. At times this generated voltage will be equal to and 180^{o} out of phase with the supply voltage, thus giving rise to a current transient of twice locked rotor current and torque transient of four times locked rotor torque.

10.4 Auto-Transformer Starters

Auto-transformer starters make use of an auto-transformer to reduce the voltage applied to the motor during start. They generally offer a choice of voltage tappings to allow a variation of motor starting current and torque within particular limits. This ability to select the voltage tapping most suited to the application provides an increased opportunity for the motor to reach full speed before transition to full voltage, thereby minimising the step in current and torque during transition. However it should be noted that as the number of voltage tappings is limited, precise control over starting performance is not achievable.

Unlike the star/delta a 'Korndorfer' connected auto-transformer starter is a 'closed transition' starter and therefore there are no current and torque transients during the transition from reduced to full voltage.

The constant reduced voltage nature of the auto-transformer results in a reduced torque at all motor speeds. For high inertia loads, starting times may be extended beyond safe/acceptable levels and for loads that present a variable start torque characteristic, optimum performance cannot be achieved.

Auto-transformer starters are usually rated for infrequent starting duties, typically 3 starts per hour. Auto-transformer starters rated for frequent or extended start conditions can be large and expensive.

10.5 Primary Resistance Starters

Primary resistance starters employ either a 'fixed metal' or 'liquid electrolyte' resistance to reduce the voltage applied to a motor during start. They provide an effective means of reducing motor starting current and torque and perform extremely well when the resistors are selected correctly.

To accurately size the resistors many motor, load and operating parameters must be known at design stage. Such information is often difficult to obtain and hence, the resistors are often selected on a 'rule of thumb' basis, thus compromising start performance and long term reliability.

The value of the resistors changes as they heat up during start. To ensure the start performance remains consistent and improve long term reliability, restart delay timers are often installed.

Due to the high heat dissipation of the resistors, primary resistance starters are not suited to starting very high inertia loads.

10.6 Soft Starters

Electronic soft starting is the most advanced form of reduced voltage starting. The technology offers superior control over starting current and torque. Additionally the more advanced soft start systems also provide advanced protection and interface functions.

The main starting and stopping advantages offered include:

- Smooth application of voltage and current without steps or transients.
- Users are provided total control over the starting current and starting torque through simple programming adjustments.
- Frequent start capability without performance variations.
- Optimum start performance for every start even in applications where the load varies between starts.
- Soft stop control for applications such as pumps and conveyors.
- Braking for reducing deceleration times.

10.7 Typical Start Current Requirements

	300%	350%	400%	450%
Agitator			●	
Atomiser			●	
Bottle Washer	●			
Centrifuge				●
Chipper				●
Compressor - Recip (loaded)				●
Compressor - Recip (unloaded)			●	
Compressor - Screw (loaded)			●	
Compressor - Screw (unloaded)		●		
Conveyor - Belt				●
Conveyor - Roller		●		
Conveyor - Screw			●	
Crusher - Cone		●		
Crusher - Jaw				●
Crusher - Rotary		●		
Crusher - Vertical Impact		●		
Debarker		●		
Dryer				●
Dust Collector		●		
Edger		●		
Fan - Axial (Damped)		●		
Fan - Axial (Un-damped)				●
Fan - Centrifugal (Damped)		●		
Fan - Centrifugal (Un-damped)				●

	300%	350%	400%	450%
Fan - High Pressure				●
Grinder		●		
Hydraulic Power Pack		●		
Mill				●
Mill - Ball				●
Mill - Hammer				●
Mill - Roller				●
Mixer				●
Palletiser				●
Planer		●		
Press		●		
Pump - Bore	●			
Pump - Centrifugal		●		
Pump - Positive Displacement			●	
Pump - Slurry				●
Re-pulper				●
Rotary Table			●	
Sander			●	
Saw - Bandsaw				●
Saw - Circular		●		
Separator				●
Shredder				●
Slicer	●			
Tumbler			●	

The above table is intended as a guide only. Individual machine and motor characteristics will determine the actual start current requirements. Refer to Section 10.2 *Reduced Voltage Starting* for further detail.

APPENDIX